THE HUMAN FRONTIER

Roger J. Williams

(Continued from front flap)

ence—the science of *humanics*—which will undertake a comprehensive study of individual human beings. The investigation of man, he contends, has fallen short of its goal because it has been in the hands of specialists, each working within his own narrow field, and he believes that what is needed today is a new type of specialist who will devote himself to new coordinated interest and attention to the comprehensive study of actual individuals.

Dr. Williams' book *Introduction to Organic Chemistry*, published in 1927, became a best seller in its field, and is used in at least 300 colleges and universities. In 1942, jointly with his brother, R. R. Williams, he was awarded the Chandler Medal by Columbia University. A member of the National Academy of Sciences, Dr. Williams is the Director of the Biochemical Institute of the University of Texas, sponsored by the Clayton Foundation for Research.

The Human Frontier

A new pathway for Science
toward a better Understanding of Ourselves

By the same author

WHAT TO DO ABOUT VITAMINS

INTRODUCTION TO ORGANIC CHEMISTRY

INTRODUCTION TO BIOCHEMISTRY

The Human Frontier

A new pathway for Science
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ROGER J. WILLIAMS

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To

HAZEL, ROD, JAN AND ARNOLD

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Contents

The Human Frontier

A man's capable of understanding anything—how the ether vibrates and what's going on in the sun—but how any other man can blow his nose differently from him, that he's incapable of understanding.—TURGENEV

I. Why the Science of Humankind?

I must first know myself, as the Delphian inscription says; to be curious about that which is not my concern, while I am still in ignorance of my own self, would be ridiculous.
SOCRATES

THE WRITING of this book grew out of a conversation, about twenty years ago, with a young colleague whose primary interest was in the social field. I asked him with admitted naïveté, "What *are* the problems of social science?" The question had never been put to him in this form before and he was unprepared to answer.

I had in mind what seemed to me the logical doctrine, taught to me by my mathematics professor in college, that a problem must first be formulated before it can be solved. This professor emphasized effectively, but almost *ad nauseam* to some, that if one didn't have in mind what he was trying to accomplish, there was nothing to be gained by blundering around. While this dictum may not be literally true in a universal sense, it seemed to me that in the field of social sciences the atmosphere would be greatly clarified if someone could outline broadly what the essential problems were, or at least classify them in accordance with their fundamental natures.

Although my professional interests have been engaged otherwise for a period of years, the recurrent question has been with me, "What, in essence, *are* the problems of social science?"

While nothing like a complete answer to this unconventional question has been forthcoming, it seems to me now that one of the essences is very clear. *Human beings* enter into every social problem,

they are to a considerable extent *unknowns,* and one of the basic problems of social science is to make human beings better known—to find out as completely as may be possible how and why they behave as they do.

The full cogency and power of this idea have never been seized upon. Certainly society has made no all-out comprehensive attempt to use the potentialities of natural science in attempting to understand human beings and their functioning in society. We have talked and written about men, and have utilized an enormous tonnage of humid air and printer's ink, but in the light of its importance our scientific investigation of human beings has been puerile in comparison with the *thoroughness* with which we have studied steel, concrete, and uranium 235.

Those who have dealt with the scientific study of man most intensively have had little or no concern for the possible social implications of their investigation. Man has been studied in pieces and not in his entirety, and we have been so devoted in our scientific work to the biological robot, *man-in-the-abstract,* that much of our knowledge is of very limited value from the social standpoint. Society can by no means be dealt with as though it were made up of individuals who are all alike, and yet this scientifically untenable conception is the basis of a large part of our social thinking and acting.

If we lived in a primitive society with health and plenty adequately provided, it would matter little whether or not we had scientific information about ourselves. In our modern world, transportation and communication have brought us close together so that in effect we live in each other's back yards. We rub against each other more often and complicated organization becomes essential to our existence. We trade with the four corners of the world, and one cannot make a significant move that does not affect one's neighbors—near or far. The same science which has made us citizens of a complex world must furnish us with the understanding of each other that is essential for mutual adjustment. *A science of human beings is essential in an age of science.*

What is needed is an all-out effort to get to the bottom of things, to understand ourselves, to find out how and why we tick. This is a job for all of us, natural scientists and students of society alike, and the time has come when the public will demand concerted action. Unless we pool our efforts and seek seriously and in a practical fashion to solve our problems we may be all engulfed together in a ruin for which all of us—like it or not—are in a sense responsible.

This science of human beings (which has for its purpose improvement in social control) we may call *humanics*.* Only by learning its basic truths, teaching them to our youth, and by extending greatly the boundaries of our knowledge can we cope with numerous social problems: education, marriage, health, employment, charlatanism in politics and elsewhere, crime, alcoholism, group bigotry (whose name is legion), and war.

2

The fundamental belief that science has broad potentialities finds justification and support in the pages of this book—a belief that science will continue to light the way for man and not burn itself out like a candle. Through science we have learned to control our material environment to a remarkable degree. Now we may hope to control ourselves.

Man has been observed and studied by capable minds for ages, and we should not minimize this vast heritage of ideas. But the scientific method is relatively new and those of us who have had experience with it may be pardoned if we confidently hope, in spite of any apparent failures, that its application to the study of human beings can help in the solution of numerous social problems. How,

* This rarely used word is defined as the "study of human nature" (*Webster's New International Dictionary*), and is parallel to mechanics, dynamics, acoustics, statistics, etc.

except through science, can we hope to discover secret weapons which can be used in combating the evils of society? What is more likely to set us free than the *truth* about ourselves?

The progress of civilization is a story of man's increasing control of the materials and forces in the world about him—a story which could not unfold if it were not for the light that science has shed. Knowledge about electricity had to accumulate before an electric motor could be constructed; familiarity with the elementary laws governing the transmission of light had to precede the building of microscopes or telescopes. A vast ocean of knowledge about atomic structure accumulated before an atomic bomb could be built. Our ability to predict, control, and use has always been conditioned upon our understanding of the materials and forces concerned.

While social institutions cannot be considered as machinery to be dealt with in a mechanical way, we may safely draw a parallel by considering human beings as the raw materials out of which social institutions are built. Our success in building these institutions rests squarely upon our insight into the behavior and interactions of the fundamental units—ourselves and our neighbors, the people who make up these institutions.

Success in leadership depends to a high degree upon an understanding of the people who are to be led. When an institution falls apart it may be likened to the failure of a dam. The forces of cohesion and the opposite ones, which tend to disrupt, have not been properly gauged. Just as the engineer or those who co-operate with him must have an intimate microscopic picture of the steel which reinforces a dam in order to gauge its strength, so we need an intimate knowledge of human beings before we can predict how they will contribute to a social institution.

There is more to the building of a skyscraper or a suspension bridge than a mere knowledge of the materials that enter into the engineering construction. In a parallel way we may venture that the building of a world social order will involve much *in addition* to the knowledge of the human beings, the building blocks of society. But human beings are the a, b, c's of social engineering, and

the basic importance of understanding them is inescapable. All insight into the organization of human beings must rest upon a knowledge of the individual units involved.

The basis of social engineering, in which art we are lagging, must be an understanding of human beings, for they are the source of our troubles, potential as well as actual. Our social problems have to do with *man's* individual and group conflicts, *man's* organizational activities, *man's* cultures and their interactions, *man's* developmental progress.

We are not threatened by some superior race, nor by some giant force from without that endangers us. Atomic energy, one of our outstanding threats, is not dangerous unless *we* make it so. If we had a serious external enemy we would study and understand it, since knowing one's enemy is half of any battle. Because the threatened disintegration of civilization has its source within men themselves, it seems obvious that we should study, with all the resources at our command, *ourselves, our own worst enemy.*

3

What sort of information and insight do we lack and what can we hope to gain from a scientific study of human beings? The answer to this question will constitute a substantial portion of this book.

In brief, understanding ourselves and our fellows will make it possible for us to provide a vastly better environment for our development—physically, psychologically, and socially. Education may eventually be revolutionized so that we become developed in accordance with our diverse capabilities, resulting in tremendous salvage in the avoidance of criminality, psychological maiming and unnecessary frustrations.

Instead of blundering our way as most individuals must do, we may develop a basis for choosing our life vocations intelligently. We may be far more successful in the choice of our mates; homes can

be strengthened and children can be reared with a new basis—a scientific basis—for tolerance and good will. A scientific knowledge of individuals raises their position to one of dignity and honor.

Instead of being constantly deluded in professions, in business, and in politics by those who pose as being something that they are not, we may develop scientific ways of *knowing* what individual people are like. Followers and leaders in all walks of life can choose and be chosen intelligently instead of on a basis of trial and error. Only by development of tolerance—based on science—and the ability to choose leaders wisely, can we hope to establish a world government. This appears to be *the* necessary next step in the evolution of a world civilization, and if such a government is based upon an inadequate knowledge of ourselves and the peoples of the world, we need not expect it to stand.

Until the full potentialities of science are brought to bear on understanding ourselves and this understanding is applied to social problems, we cannot say that science has failed; we can only say that we have failed to give it a thorough trial.

4

Where have we failed? Where has neglect occurred? What scientific knowledge and insight can we gain that will help us in achieving our objectives? Certainly, science has not been asleep.

A large part of the extensive scientific investigation of man has, however, fallen short so far as social application is concerned, because of its nature and because it has, almost of necessity, been done by scientists with narrow special interests and training.

The general pattern for studying man scientifically has been about as follows: an anatomist, for example, is concerned with the structure of the human body and in his study he makes many measurements, carries out many dissections, and produces many microscopic slides, from which he can learn the intimate details of body structure. If he is to discover new information he must specialize on

some part of the body, on some organ, or on some specific type of tissue. By the labors of a large number of anatomists, each working separately, it becomes possible to amass in libraries more and more complete information about the intricate details of every tissue and organ in the body.

Physiologists follow the same plan. One studies muscle physiology, one digestion, another becomes expert in the physiology of hearing, still another studies intensively some phase of the circulatory system. A large number of individual specialists amass information about the functioning of the numerous organs and tissues. Biochemists try to push the curtain further back and try to determine what is going on chemically in each tissue and organ. Psychologists specialize on various phases of mental activity and, by their individual efforts, accumulate a vast fund of knowledge about diverse aspects of the human mind.

The outcome of this method of attack is that no individual scientific investigator is encouraged to know or care about the whole picture of man. The osteologists are interested and conversant with what is transpiring in the field of bone anatomy; the nerve physiologists know the current ideas about how nerve impulses are propagated; the enzyme biochemist is familiar with the composition and functioning of respiratory enzymes; the psychologist may specialize on the problem of how learning takes place. And so on and on.

Whose business is it, to know man in his entirety? Who can advise us how man's nature fits into the structure of society? Where is there co-ordinative expertness with respect to *man?* One may answer that anatomists, physiologists, biochemists, and psychologists, etc., are not always narrowly trained. They are all citizens and have their social responsibilities. In practice, however, what is everybody's business is nobody's business, and the responsibility for the broad scientific study of man falls exactly in that category.

In a few isolated instances investigators have taken the problem of the scientific study of man seriously and in spite of limited facilities they have made some substantial progress. Sheldon and Stevens in their *Varieties of Temperament* (Harper, 1942) describe such a

work. But society's contribution has been piddlingly small and provision for such work has not been at all commensurate with its importance. Earnest Hooton, famous anthropologist at Harvard, speaking of deans, tutors, and headmasters who have human problems dumped in their laps, says, "They use their experience, their common sense and their humanitarianism, but they do not draw upon a science of man *because there is no such thing.*"[1]

The scholars in various fields must find some way to pull themselves together so that they can focus on the science of human beings. This may be difficult, but I believe that when the public is informed, it will be strongly for it, and will not be inclined to take no for an answer, principally because this type of study offers hope for future progress in the field of human relations, and in the solution of the giant problem of social control which confronts us in the Atomic Age. We must have our specialized sciences, yes; they are the basis for all investigation and progress. But the time is now come when the public will demand that natural scientists and students of society alike face in a practical manner the problems of society and man's relation to them.

5

A second defect of our scientific study of man from the standpoint of its social utility is not unrelated to the one just discussed and is fully as serious. It is our preoccupation with *man-in-the-abstract.*

It has developed, as we have noted, that our science does not provide for any experts who are conversant with man as a whole. Not only that, but our science has not provided for the *thorough* study, under any circumstances whatever, of any individual human beings. A study to qualify as thorough would have to be made from

[1] Corresponding to such reference numbers as this one, there will be found in the Bibliography citations pertinent to the subject matter under discussion.

the standpoint of various branches of science. To a degree the searchlight of science has been turned upon man-in-the-abstract, and one can find out a vast amount about him if he consults enough books and journals in enough libraries. *But the full searchlight of science has never in any instance been turned on a real individual, living or dead.*

A consideration of the scope of a recent collaborative study of 258 normal young men at Harvard University should convince the reader that I have not been guilty of exaggeration. While this study is probably more comprehensive than any other, special psychological capacities and various types of important aptitudes were not considered. Much of the study was of a subjective nature.[2]

During the late war various government agencies carried on numerous scientific investigations with conscientious objectors and others as subjects. The writer is in possession of a number of the reports, which were issued as restricted and not available for quotation. Some of these studies were relatively intensive especially on the physiological side, but they were not in any sense comprehensive.

The people who make up society are certainly not all alike, and any attempt to deal with them as if they were is foredoomed to failure. Obviously the world which we inhabit would be wholly different from what it is if every individual were an exact replica of every other individual. It seems equally clear that the roots of many conflicts and problems lie in the *differences* in appearance, *differences* in opinions, *differences* in attitudes, and *differences* in behavior on the part of members of the human family. Scientific study which has for its purpose the improvement of social behavior must understand these differences, seek out their origins, and finally develop the means whereby we can adjust ourselves to them.

For the practical purposes of social engineering we must turn our attention away from the biological robot, *statistical man,* and devote it to *actual human beings.* Instead of being concerned primarily with man's digestion, we will need to think of men's digestions; instead of concentrating upon the education of man, we will be in-

terested in educating men; what men see will be more important than man's eyesight. The hypothetical concept of human nature will give way to a serious study of men's natures.

The failure to pay attention to individual men is either serious or inconsequential depending on whether individuals are very much alike or whether they differ markedly one from another. If each individual is approximately like every other individual, then when we know one, we know them all; when we know the characteristics of Mr. Average Man we know enough so that we won't go far wrong in assuming that everyone else is like him. But if, as we shall show in the main portion of this book, individuals show wide fundamental variability, then our assumption that society is made up of replicas of Mr. Average Man may be so far from the truth that we are led astray. This, I believe, has actually happened.

In our thinking about social problems, in our education of citizens, in our social planning, in our social legislation, we proceed on the assumption that society is made up of average individuals, who have the characteristics of the man-in-the-abstract, that our natural sciences have investigated. If this supposition is correct or approximately so, well and good. Actually, however, such an assumption is indefensible.

The danger of becoming statistically minded on all occasions is illustrated by a story that is told of an elderly Scotch judge who was reminiscing over his very long record on the bench. He admitted that in his day he had probably freed a good many guilty people, and that likewise he had probably sent a goodly number of innocent men to the gallows—but he consoled himself with the thought that the over-all average of his record looked excellent. His errors of severity were counterbalanced by his errors of leniency!

6

There is an acute need for scientific study of human beings directed along the lines suggested in the body of this book. This study

will be of a practical nature and have as its purpose the development of all possible information and insights that will make social control possible.

This is not the time for society to locate the blame for our present predicament. To attempt this now would be something like boating companions whose boat has suffered a mishap and who are perilously floundering far from shore, attempting to settle the question as to who overturned the boat. When civilization is safe, historians can look back and tell their contemporaries in an impartial fashion how it became so, or why it didn't happen sooner.

The ultimate goal of our efforts is social welfare. This is accomplished when the physical and social environment is adjusted for the maximum development of every individual. Since, as science demonstrates, people show wide variability in every respect, the environment which is suitable for one will not be suitable for all. Society must accommodate itself to individual needs. Since it would seem impossible to adjust separately to all of the idiosyncrasies of each individual, the logical way to proceed is for science to develop methods of classification which can be used as a basis for giving individuals who are nearly alike in a particular respect a similar environment in connection with that particular item of their existence.

Once we know what the differences are, and how human beings may be classified with respect to them, the individual problems which will confront us will be essentially like that of fitting a human population with shoes. There are no two pairs of feet in America that are precisely alike, toe prints and all, and offhand it might seem impossible to use large-scale methods and at the same time fit everyone with comfortable shoes. Actually it is not so difficult. The majority of people get along very satisfactorily if their shoes are approximately the right length and width and are built according to a standard last. Some feet require special attention for maximum comfort.

Our attempted social adjustments, however, are often so crude that they might be compared to furnishing an entire army with

average-sized shoes. For purposes of calculating the amount of leather required to put shoes on an army it would be valuable to know the average size of the soldiers' feet, but this information would be of no value in ordering the sizes to be made. An average-sized shoe would fit very few individuals.

7

Naturally in our scientific study of humankind we shall be interested in the fundamentally practical question as to what extent the observed differences in human beings are based upon hereditary factors. This is not always easy to decide as will be emphasized in a later chapter. Regardless of their origin, however, the differences need to be recognized and understood as well as possible. Whether we are color-blind or not depends upon our heredity; whether we enjoy reading or not has a hereditary basis, but there is a superposition of highly important environmental factors; whether we do our reading in English or in French depends entirely upon the culture in which we are reared. Scientific knowledge and scientific versatility can be depended on, when they are applied, to light the way in any case so that the origin of differences may be understood.

When individual differences, which appear wholly troublesome, are faced and better understood they should turn up on the credit rather than the debit side of humanity's ledger. Biologically, in fact, differences are fundamental to all progress.

Because men are exceedingly complex and our knowledge of them must necessarily be incomplete, we should not be discouraged with the practical possibilities which increased knowledge will bring. If we consider the contents of the several thousand scientific periodicals that are published regularly all over the civilized world we cannot help standing in awe of what man has accomplished in the field of science. An examination of the same sources of information will convince us also that scientific knowledge is by no means

complete in any field. No scientist would entertain for a moment the idea that we know all about electricity or light or any of the other phenomena which have been subjected to scientific study for many decades. Complete knowledge does not precede application. Even though we have not, from the social standpoint, taken the science of mankind seriously, our increased knowledge in recent decades has already borne much fruit.

Our emphasizing practicalities does not indicate a desire to detract from the value of purely scientific study. When the scientist exercises his curiosity and delves into the secrets of nature for their own sake it may appear useless, but actually he is laying by a store for future generations. Galvani in curiosity studied the effects of metals on the twitchings of a frog's leg, and at the same time unwittingly laid the foundation for modern electrical science which was to arise and become useful in the following centuries. No one can guess when or how or where the knowledge that the scientist uncovers will bear fruit and no one can deny that the secrets of nature are of absorbing interest regardless of their immediate, practical import.

An enlightened society will not only support purely scientific work generously because it is the spring from which insight arises, but also will contrive to apply its scientific findings continuously to all practical operations. It will never allow useful information to lie dormant and undeveloped. The time has now come for us to extract from the available scientific information every possible ounce of help, in order that society can thrive and progress.

8

We must not conclude that because society's half-hearted, partial or superficial study of mankind has failed to yield the answers most desired, a thorough study will also fail. In the natural sciences we go to what the layman would regard unbelievable lengths to find out about the materials and phenomena that we wish to use. No

device or method of approach is too exacting or too laborious if it throws light on the behavior of the material studied. In our present plight we should not take the study of man less seriously. To use all the resources of biology, psychology, chemistry, and the other supporting sciences, especially when they show evident promise, is our obvious opportunity. Surely the stakes are high enough!

It would indeed be a shortsighted mistake to limit the study of human beings in a manner to fit in with our preconceived notions. We should accept the broad scientific point of view. If man is to be studied, *every* phase of his life will be worthy of attention. It would be hazardous to leave out any part of man's existence, because the very thing omitted might be an important key to his behavior. Music, poetry, art, religion, and emotion are facts of life just as real and compelling as any other facts, and no one who strives for a thorough understanding of men could close his eyes to them. While the appreciation of music or art does not usually come as a result of scientific study, yet a thoroughly scientific attitude recognizes art and music as important factors that enter into the life of men.

If it is true, as many sociologists hold, that men cannot properly be considered to exist except as members of a society, the facts must be faced realistically. A scientific attitude involves no disposition to dodge anything that is true. Science has in its day entertained all sorts of hypotheses, and no type of objective facts or evidence need remain outside scientific consideration.

If man's position and status can be grasped only by a study of the developmental history of himself and his biological colleagues, this fact does not lie outside of science. If heredity plays a larger or smaller role in our lives that we are wont to consider, the methods of science alone can demonstrate the facts and offer us the indisputable proof that may serve as a basis for further extension of our knowledge. If, as some would hold, man's troubles are mostly in his mind, and psychological factors outweigh all others, this is something that we need to be sure of and to know more about. Only

scientific study can make us sure and point the way to whatever remedies may exist.

In short, science encompasses many fields of knowledge. In the broadest sense any kind of investigation which has for its purpose the discovery of truth is scientific.

9

It is beyond the scope of this book to deal philosophically with man's nature. Our interest is more in the practical work-a-day characteristics of human beings. It will be logically necessary, however, to discuss problems on the basis of the acceptance of certain premises or postulates. Euclid postulated that a straight line is the shortest distance between two points and founded his geometry on this assumption. If anyone wishes to deny this postulate, he eliminates himself thereby from a study of Euclidian geometry. We must use postulates as the basis of our discussion, but we must also admit the possibility of disagreement with these postulates. In the event that the postulates are not acceptable, subsequent discussions cannot be satisfactory.

First, we must, in common with all scientists, accept the general idea of the uniformity of nature. Nature is governed by laws and scientists have learned to depend on nature's behaving in a consistent fashion. This does not mean that the minute details of every physical or chemical event are in themselves determined and predictable, but that over-all processes are law-abiding and consistent.

A truly scientific attitude is one of humility. There is a realistic facing of the fact that whereas the universe is law-abiding, we are not yet acquainted with all of the laws. A know-it-all attitude is incompatible with the scientific method.

We must accept the postulate that human beings are in a practical sense free agents. A common-sense view of life excludes rigid determinism; otherwise all efforts to modify our environment, ourselves or society are utterly futile and meaningless. We must also

accept, however, the idea that man's freedom is limited and not complete. This point will enter in an important way into later discussions.

Until forced to do otherwise we shall adopt an optimistic and fearless attitude. In the modern age we have fortunately banished many fears—but I think there remains a lurking fear in many minds that if we attempt to pick man to pieces scientifically, we may spoil him. Experience points in the opposite direction. While science may appear superficially to depreciate the things it studies, in the long run it always enriches them. Man appears most remarkable not to the person who is most ignorant, but to the scientist who knows a great deal about his intricacies and sees in him wonders not even vaguely imagined by the non-scientific observer.

We should have no fear in following the truth wherever it may lead. More complete understanding of ourselves can lead only in one direction—toward better adjustments to life and to each other. I believe that our later discussions will make it clear how knowledge of ourselves, regardless of our capabilities, will have the effect of increasing our morale and our satisfaction with life. Errors in understanding of ourselves and others can lead only to trouble.

10

Above all we must see the urgency of the task; a new science must be developed—one which will concentrate on the comprehensive scientific study and understanding of actual human beings, such as those represented by ourselves, our neighbors, associates, friends, and enemies. It should be of the nature of an *applied* science—one that is developed because of the practical service it will render in the field of social relations.

In the chapters which follow we shall bring together from diverse and often highly specialized sources a fund of information and insight in an attempt to outline this difficult but crucially important science. We shall indicate how this information which is already

available is socially important, and how the wide dissemination of what we already know will go far in promoting morale, tolerance and mental health. Only by *extending* this knowledge and giving it to our youth can we find a basis for solving a multitude of social problems. In the later chapters a number of these specific problems will be discussed in the light of what human exploration can do.

II. Fundamental Metabolism as It Is Related to Character Traits

The proper study of mankind is man.
ALEXANDER POPE

In our consideration of what science can teach us about human beings and how this knowledge can aid us in obtaining adequate social control, let us not be content with superficialities. Let us consider first some of the basic facts about the workings of our bodies, and how we derive our physical energy, because actually an insight into the nature of these processes is essential to an understanding of how we human beings tick—how we are alike and how we may differ one from another.

In order to carry on the numerous and intricate affairs that make up our physical existence, we must obtain energy from the combustion of fuels and in order to keep this process going and maintain the body machinery in working order, many complex chemical changes must take place continuously. This slow combustion or burning of fuels, along with the multitude of accompanying reactions which take place in the billions of cells of our bodies, is what we call metabolism.

The general features of the over-all process of metabolism are essentially the same for men and for higher animals. We consume the same types of fuel—principally carbohydrates, fats and proteins—and the processes of digestion and metabolism which ensue are in their broad outlines the same. Our bodies and those of animals produce—automatically as far as any conscious desire is concerned

—a host of special catalysts called enzymes which make possible and lubricate specific types of chemical reactions that need to take place in the burning process. These numerous catalysts are built into the tissues where they are needed and their activities are controlled in a most intricate fashion.

The burning process as it occurs in our bodies is far more complex than the burning of gasoline in our automobile cylinders. Lead tetraethyl is something like a catalyst and is put into gasoline to make its combustion take place more smoothly. However, cars ran long before its use was discovered, so it is not essential. The burning which takes place in our bodies, on the other hand, involves many different fuels, many intricate intermediate steps, and many special catalysts which, unlike lead tetraethyl, are individually absolutely essential to the whole process.

It has long been recognized that man and higher animals are similar in anatomy and this is often cited as evidence of kinship. Fully as important is the fact that metabolism in man and higher animals has many resemblances. The machinery in each case is similar not only in gross construction, but many of the intricate details of its operation are approximately the same. Science has discovered much about the laws that govern the inheritance by man or animals of their anatomical machinery. We are beginning to have definite and striking proof that this heritable machinery includes the specialized enzymes or the ability to produce them as clarified by Beadle and his co-workers, and that it is for this reason that our metabolism follows a pattern derived from those of our forebears. Two animals which inherit identical anatomical structures have the machinery for carrying on metabolism in exactly the same way, but if there are differences in their anatomies (including microscopic and sub-microscopic details) then their metabolisms will show corresponding variations.[1]

When we look closely into the details of the process of metabolism, it becomes evident that not only do different species of animals differ in the details of the process and not only do men differ from animals in this respect, but *each human being has a metabolic*

pattern which differs in some respects from that of all his fellows. This fact is important for it is probably upon these fundamental metabolic differences that our observable individual differences rest. If we could imagine two individuals whose various bodily structures even down to the minutest details were the same, then the metabolism in their various internal organs, in their glands and in the nerve cells throughout their bodies and in their brains would be the same and we would have duplicate individuals without individual differences. The nearest approach to this in actuality is in identical twins in whom about the only differences are those which may result from environmental influences that operate after birth or even before birth while the fetuses lie together in the mother's womb.

2

A concrete and readily observed demonstration that individuals differ in their metabolisms may be witnessed in the case of two children of the same household—one lean and one fat. Both have access to exactly the same food and yet the results are quite different. One tends to deposit much fat, the other very little. Even if we account for the difference by the fact that one child eats more than the other, this has a metabolic basis because desire for food comes from within and if one person consistently has more appetite than another, this is conclusive evidence of a difference in internal metabolism.

As another homely evidence of differences in metabolism among normal people we may cite the old nursery rhyme about Jack Sprat and his wife. It is commonly recognized that individuals do not utilize equally well every kind of fuel. Some can utilize fat with relative ease; others cannot. This is related to another fact recognized by biochemists—that in fat metabolism some individuals have a greater tendency to ketosis (formation and excretion of acetone and related substances) than do other individuals.

One need go no further than popular impressions to find indica-

tions that the metabolic differences just mentioned are important in connection with people's behavior. Is there not a common belief that obese people tend to be jolly and good-natured while lean people by comparison tend to be cranky and quarrelsome?

Such observations, unfortunately, are not on a scientific basis. It is regrettable that we do not have scientific knowledge about the relationship between the general metabolism of individuals and their dispositions. It is common medical knowledge that those individuals who have a very high rate of metabolism are liable to be nervous, excitable and fidgety, whereas those whose burning processes are very slow tend to be sluggish, but altogether our information on such matters is scanty and inexact.

The basic questions which we have been propounding as to the relationship of disposition to metabolism would, if they were in the realm of physical science, be considered elementary. If one asks a metallurgist whether the presence of carbon has an influence on the strength of steel, he has enough exact information on the subject to fill a book. Whom can we ask about the relationship between metabolism and disposition? The physiologist or biochemist who is competent to study metabolism is not concerned with people's dispositions, and psychologists who might be interested in people's dispositions are not students of metabolism. It will be one of the tasks of human exploration to study such relationships as these—to cut across the artificial borders that separate the branches of science from one another and to study human beings by every available means.

3

Our differences in metabolism are not limited to the broad characteristics already outlined. Some of the common distinguishing personal features which we as individuals possess are clear reflections of metabolic differences. When we say that one has inherited black hair, for example, we are speaking inaccurately because what is inherited is not the black hair, but the specific catalytic systems

which are capable of producing the pigment which colors hair black. The intricate and submicroscopic mechanisms for producing pigments which color the hair and the skin vary from individual to individual. The production of these pigments (the raw materials of which come from the food) is a part of metabolism, and the mechanisms for their production are inherited.

Albinos are relatively rare individuals who have failed to inherit a workable mechanism for the production of skin, hair and eye pigments. Some part of the necessary machinery is left out of their make-up. In addition to albinism there are at least seven other heritable metabolic conditions which are known to biochemists: alcaptonuria, cystinuria, pentosuria, porphyrinuria, steatorrhea, phenyl ketonuria and tyrosinosis. A detailed discussion of these metabolic traits would be out of place—each condition arises in some of the numerous body tissues and results in the excretion of specific identifiable products. Alcaptonuria is the easiest of the group to recognize, because the urine of individuals inheriting this metabolic characteristic turns black on standing. A chemical product—homogentisic acid—is present in the urine of such individuals from birth because the inherited catalytic systems yield it as a product of partial oxidation.[2]

The other metabolic peculiarities listed above are for the most part recognizable only as the result of chemical examinations. They have been discovered, often by physicians, as a result of a more or less chance observation of patients. Exhaustive or systematic searches for such metabolic traits have never been made and a number of those mentioned have been studied in only a limited way. In addition other identifiable but unusual products of metabolism have been found in urine occasionally and there seems little doubt that many metabolic traits which might be recognized by study directed to this purpose, have so far been overlooked. Individuals who excrete an unusual metabolic product may do so to different extents, so that conditions not only differ in kind but in different degrees.

In only a few of these recognized metabolic traits are there known

correlations with any other easily recognized trait. Associated with albinism is a deficiency in the sense of smell (anosmia). In the case of phenyl ketonuria the accompanying condition is serious—feeble-mindedness. Evidently the peculiarity in the inherited catalytic system which makes impossible the burning up of phenyl pyruvic acid also makes impossible high-grade mental activity. While all individuals who excrete phenyl pyruvic acid are feeble-minded, there are numerous feeble-minded whose difficulty lies in some other quarter, because no sign of this particular substance is found in the urine. No extensive psychological studies have been made of phenyl ketonurics to ascertain exactly what type or types of mental deficiencies exist.

The possession of distinctive metabolic traits or trait-patterns is by no means limited to freaks or to unusual individuals. Perhaps the most direct proof of the existence of a distinctive metabolism for each of us lies in the fact that animals with a keen sense of smell can distinguish one individual from another. The odors are due to metabolic products—mixtures of chemical substances—which are released in minute amounts and may adhere to the skin or clothing. Even though two individuals consume the same food, their differences in metabolism are sufficiently great so that a bloodhound, for example, can distinguish the "blend" of each, even by following a trail that is hours old.

4

Many biological evidences can be cited to show that our body tissues have individuality. For example, extensive grafting and transplantation experiments on animals, described by Leo Loeb, have shown that when a piece of tissue is transplanted from one position to another on the same animal, the results are quite different from those obtained when the transplantation is to a different animal. If the animals in question are closely inbred and have a very similar inheritance, then transplantation to a different

individual may cause relatively little disturbance; in fact, for months the transplantation may behave like one from the same animal, although eventually differences appear. If a tissue is grafted to an unrelated animal of the same species, the reaction may be severe.[8]

The higher the animals are in the evolutionary scale, the more individuality they show and the more difficult it becomes to transplant certain tissues from one individual to another. The various tissues of the body differ in their behavior on transplantation. Fortunately some tissues—in the eye for example—do not show individuality and can be transplanted readily. Skin can be grafted from one part of a person's body to another part with success. Skin from a close relative sometimes can and sometimes cannot be successfully transplanted. If the transplanted skin comes from an unrelated individual (who has many differences in his inheritance) the transplant usually does not "take."

The existence of four principal blood groups, O, A, B, and AB, which must be recognized in connection with blood transfusions, is based upon the presence or absence in the blood of different individuals of antigenic substances A and B. Those in group O possess neither A nor B; those in group A possess A only; those in group B possess B only; those in group AB possess both A and B. These blood differences, which are inherited, exemplify how the chemistries of our bodies differ.

While the four listed above comprise the more important blood groups, there are other significant and distinctive substances which may or may not be present in the blood of individuals. These are the M and N factors and the recently discovered Rh factor which is connected with fetal anemia and death. These are inherited independently of A and B. Taking these into account there are twenty-four types of blood which people may possess. Actually, however, a considerable number of subgroups exist, related for example to the possession of modified A's and Rh's. These multiply the number of distinguishable blood types to several times twenty-four. If one wished to push the classification of blood types to the scientific limit, the number of types would be very large. Whether this is

desirable or useful from the practical standpoint is a question which we need not discuss. Regardless of this, we find in the study of blood types ample evidence that our internal chemistries differ one from another.

The chemical differences between individuals which become apparent in transplantation experiments and blood groups probably have to do with subtle differences in the proteins present. Differences in other types of tissue constituents, as determined by ordinary analysis, also reveal individuality. For example, in a group of ten individuals studied over a period of months it was found that each tended to have characteristic amounts of lipid (fatty) materials in the blood regardless of ordinary changes in the diet. One of the four men, who was in good physical condition, consistently had only 60 per cent as much cholesterol as the maximum, and 64 per cent as much fatty acids. In another study involving 300 women, one individual had a blood phospholipid content only 37.5 per cent of the maximum. These consistent differences offer concrete evidence that the metabolic machinery differs somewhat from individual to individual.

5

An entirely different line of evidence also indicates that every human being has distinctive metabolic traits which form the basis for individuality, a conclusion of first importance in understanding the human species.

The effect of a drug upon the body is due to an interaction, often obscure, between the drug and some portion of the metabolic machinery. Drug action is often difficult to study, not because of the complex chemistry of the drug itself, but more particularly because of the complexity of the mechanism with which it interferes or which it influences.

If drugs had precisely the same effect on different individuals this could be taken as evidence that the metabolic mechanisms are

identical. Actually the opposite is true, and the facts indicate that the metabolic mechanisms are distinctive.

Drugs that have come to be depended on are those that are *relatively* uniform in their action. Those drugs which are highly irregular in their action, whether of synthetic or natural origin, have been discarded because unless a drug can be counted on to have approximately the same action upon a large majority of individuals it is useless.

Even those drugs which have come to be depended on and are useful for most individuals are not always effective in the same doses. In the use of barbiturates for inducing sleep or in the administration of thyroid tissue or of sex hormones, it is found that individuals vary greatly in the amount required to give the desired effect. The physician often experiments in the administration of drugs—giving first small doses and then larger and larger until the desired results are obtained.

Sometimes differences in the susceptibility of individuals are marked, and have given rise to false interpretations. For example, some individuals respond to the subcutaneous injection of adrenaline by an extraordinary rise in blood pressure and pulse rate. At one time it was thought that this was indicative of exophthalmic goiter (Graves' disease) but it is not. Some people wholly without Graves' disease respond in this manner due, as we must conclude, to definite metabolic differences which are as yet unknown.

The study of drugs and drug action is highly complicated without paying attention to individual responses, and pharmacologists have usually treated these individual differences in an offhand manner. It is well known that in order to test a drug adequately it must be tried out upon a number of animals (which do not necessarily respond alike) and that tests involving a single animal are unreliable. It is also well recognized that different species of animals respond differently to drugs—for instance, morphine excites cats but depresses dogs and most other animals—and that for testing a drug an appropriate animal must be used.

Even those drugs which have come to be recognized as standard

have unusual actions upon some individuals. Morphine, for example, puts most individuals to sleep, but an occasional individual may respond quite differently. His mind may be stimulated in such a manner that thoughts race through it pell-mell, causing great mental distress. This indicates that the chemistry of the nervous system or the approaches to it are not identical in the two types of individuals.

Novocaine is another important drug which fails to act uniformly; in some individuals it does not cause anesthesia when administered in the usual doses. A student who worked in the author's laboratory found out by experience in the dentist's office that novocaine was not effective for him. Later he found it out all over again and underwent a tonsilectomy without effective anesthesia, because novocaine was the drug used.

A drug is usually considered satisfactory if it is effective in a large proportion of the cases in which it is tried. For example, a recently developed anesthetic technique for childbirth was tried upon 10,000 cases; it was completely effective in 81 per cent of the cases, but there were 1200 who had slight pain and 700 more for whom the anesthetic didn't work at all. Similarly, in testing a drug found to be effective in preventing air sickness in flying cadets it was found to be effective in eleven cases out of twelve. These facts, coupled with the fact that drugs are selected to act as uniformly as possible, bear out the conclusion that our internal chemistries are not the same.

Even the most widely used drugs occasionally yield unusual results. The sulfa drugs cause extreme nausea much more readily in some people than in others; aspirin sometimes excites individuals and in some rare cases disturbs the heart; the old stand-by heart remedy, digitalis, in rare and anomalous cases induces a synchronized heart rhythm in addition to slowing the ventricular rate; cinchophen was used in the treatment of gout for many years before it was found that it may cause fatal toxic hepatitis; penicillin in rare cases may produce a violent reaction. Measures which are usually highly advantageous, such as giving diphtheria shots, may occasionally yield serious results.

Three physiologically active substances that enter into the everyday life of many people—caffeine, nicotine and alcohol—are variable in their action, and since these are so commonly used it will be worth our while to discuss them briefly.

Caffeine is the active ingredient of tea and coffee; it is sold in tablet form and found to be effective in most cases in preventing sleep. However, different individuals vary greatly in their response to this substance. Some can sleep soundly after having drunk several cups of strong coffee, while others may be kept awake for hours by a portion of a cup. Caffeine is caffeine wherever you find it, but when it gets into the human body its effects may differ widely depending upon the exact make-up of the individual that takes it.

Nicotine is another commonly used drug which does not affect every individual in the same way. One important factor in this case is the ability which at least some people possess of becoming adapted so that they become less responsive to it. It is well known, for example, that a youngster's first cigar may make him deathly ill, but that some men, by dosing themselves mildly over a period of years, are able to smoke one cigar after another all day long without becoming ill. Pharmacologists say that some people never can get adapted to the free use of tobacco. If this is so, it is an important fact in connection with our later discussion.

There are two diseases which are recognized by the medical profession as being associated almost invariably with the use of tobacco. The diseases are rare and most people who smoke *never suffer from them at all.* Those who do are affected, we must conclude, because of unusual metabolic susceptibility to the action of tobacco. The diseases are tobacco ambylopia, which results in optic atrophy and blind areas being produced on the retina, and Buerger's disease (thrombo-angiitis obliterans) which causes severe vascular spasms and induces gangrene, necessitating amputation. These diseases are rare.

Wide variability of response to nicotine is the rule rather than the exception. People react differently toward the habit-forming effects of tobacco. Some smokers are apparently able to stop and start at

will while others are much more closely tied to the habit. This probably has a physiological basis. Pharmacologically nicotine is very complex in its action.

Dr. Raymond Pearl's classical study, involving 6,813 men, on the effects of tobacco on longevity revealed some interesting information in this connection which was a by-product of his study and the significance of which was possibly not fully grasped.[4]

He classified the large group of men (white), on the basis of reliable information, into three groups: (1) non-smokers, (2) moderate smokers, (3) heavy smokers. None of the men selected for the statistical analysis chewed tobacco.

One half of the heavy smokers in the group were dead 17½ years after the starting age (30); it was, however, 26 years before one half of the moderate smokers had died, and 28 years before one half of the non-smokers were dead. This indicates strongly that smoking—especially heavy smoking—decreases statistically one's life expectancy at 30 years of age, by a number of years.

However, when the death rates of the three groups were compared after the survivors had reached the age of 70, the statistical advantage of the non-smokers practically disappeared even when they were compared with the heavy smokers. Dr. Pearl explained this on the basis that those "who survive to 70 or thereabouts are such tough and resistant specimens that thereafter tobacco does them no further measurable harm as a group."

The findings of Dr. Pearl may be reasonably interpreted if we make the justifiable assumption that individuals differ in susceptibility by inheritance. Some inherit a metabolic pattern that is susceptible to the chronic effects of nicotine, others possess metabolic set-ups that are resistant to it. By the age of 70 practically all those who are susceptible are weeded out (often by coronary thrombosis), and the remainder—about one third of the heavy smokers—live on unmolested by the effects of nicotine.

It has been pointed out that Dr. Pearl's studies do not offer indisputable proof that tobacco decreases longevity. An alternate explanation is that those who are by inheritance short-lived are for

some reason predisposed to become tobacco users, and that actually the tobacco is not a responsible agent. This explanation is not untenable on the basis of present information but it seems that there is no independent evidence in favor of it, and that such a view would not be embraced unless one had some strong reason for wishing it to be valid.

Taking all the facts into consideration it seems very likely that some people have their lives materially shortened by tobacco, but that others are practically unaffected. On this basis it seems entirely reasonable that some individuals should live to ripe old age even though they use tobacco all their lives. The fact that someone's grandfather smoked incessantly and lived to be 92 does not prove that smoking is harmless for everyone else.

The facts with respect to the effects of tobacco are eminently worth knowing—from the standpoint of life insurance companies and their clients if for no other reason—but due to our over-absorption in man-in-the-abstract we have never sought the answer diligently. If studies were directed to this end, it would probably be possible to determine *in advance* whether an individual is slightly, moderately or highly susceptible to the harmful effects of tobacco. If one is a heavy smoker and lives past 70, this is a pretty good indication that he belongs in the resistant group, but this is a long time to wait for the answer—too long in fact to derive any benefit.

With respect to the use of alcohol, it is common knowledge that people become adapted to its use in the same way as they do to the use of tobacco. Persons who are accustomed to drinking are less effected by a given amount of liquor than are the uninitiated.

It seems likely, however, that the same situation exists with respect to alcohol as has been described in connection with nicotine—probably people have variable reactions to its chronic effects and regardless of temporary adaptations some are much more liable to be damaged by its continued use than others.

Variability in individual responses to alcohol is indicated by the fact some persons show intoxication when the alcohol content of the blood is comparatively very low. In most cases of intoxication the

alcohol content of the blood is between 0.15 per cent and 0.30 per cent. However, in studying this problem, it was found in one instance that four out of 38 persons (10.5 per cent) showed intoxication when the alcoholic content of their blood was 0.05 per cent, and that 10 per cent of a larger group *failed to show* intoxication when the alcohol content of the blood was five times this high, namely, 0.25 per cent. A very high percentage of persons (but not all) show intoxication when the alcohol in the blood rises to 0.30 per cent.

Furthermore the effects of alcohol addiction are by no means uniform. Some develop psychoses; others do not, and the psychoses that develop are of diverse types. In addition to the effects of alcohol addiction there develop in relatively rare cases conditions which are described as "pathological intoxication." This may result from the imbibition of a relatively small amount of alcoholic liquor and neither constant users of alcohol nor infrequent users are immune. The individual in such a case often becomes berserk and commits depredations and crimes of which later after a long sleep he has no memory. This acute and temporary type of condition accounts for 8 to 9 per cent of all first admissions for alcoholic psychoses in the New York State hospitals.[5]

Epileptics are unusually susceptible to alcohol and two leading authorities on pharmacology indicate the existence of a highly susceptible group among more normal individuals when they say alcohol should be forbidden to patients who may easily become addicted to it. They also indicate that alcoholic patients are often hereditary defectives.

It is estimated that there are about 600,000 men and women in this country who are so seriously addicted to alcohol that they need medical help. This is about 1.3 per cent of the total number who make some use of alcoholic beverages. These inebriates come from all social, educational and economic levels—the well-to-do furnishing a larger than proportional number.

It may be that these particular individuals have been subjected to peculiar psychological stresses and that these conditions alone are

responsible for their unfortunate state. On the other hand, a number of facts in addition to those already cited indicate that addiction to alcohol has its basis in the fundamental metabolism of the individual which in turn has a hereditary background. This is not to say that psychological stresses remain outside the picture.

It appears to be well established that some individuals can remain moderate drinkers throughout life without effort, but that others develop a strong craving which can be overcome, if at all, with the greatest difficulty. For them total abstinence is the only alternative; they appear to be wholly unable to drink moderately.

It is estimated that there are about seven times as many drunkards among men as among women. This is no doubt due in part to social custom, but sex differences with respect to metabolism are well recognized and it could be that the metabolic machinery in women is such that they have less tendency toward alcoholic addiction. Women are undoubtedly subject to psychological stresses as are men, and if this were the main basis for alcoholic addiction one would think that the distribution between the sexes would be more even.

In discussing alcohol as a psychiatric problem, Dr. Adolf Meyer has pointed out one of the strong evidences that a tendency toward alcoholic addiction may have a metabolic basis and may be inherited. He says in connection with his work at the Worcester, Massachusetts, State Hospital, that there was a remarkable uniformity in the action of alcohol within racial groups, but that different racial groups often showed wide contrasts. In the case of those of Irish descent, for example, 37 per cent of the psychoses were alcoholic, whereas among the Jewish patients only 0.5 per cent of the psychoses were alcoholic; Germans, native Americans, English and Scotch were consistently between these extremes. Very similar results were also reported from the Manhattan State Hospital in New York.[6]

In view of all the other available facts regarding individual differences in metabolism it seems entirely reasonable to think that in each racial group there is a certain percentage (which, however,

varies with the group) of those who have metabolic traits that predispose toward alcoholic addiction, and that the inebriates come from this percentage.

This question merits much more study than it has received in view of its importance as a social problem. If we make the tacit assumption (which is a common one) that potentially people are all alike and would become drunkards if they encountered appropriate frustrations, etc., then the social problem of alcohol becomes defined in terms of this assumption. However, the problem takes on an entirely different complexion if, because of metabolic differences, only a small percentage are unusually susceptible and are liable to become drunkards. It is important for society to know which of these alternatives to accept.

If there are individuals who are unusually susceptible to the craving for liquor and to its habit-forming effects, it should be possible by intensive study directed to this end to learn how to distinguish such individuals. It should be expected that there would be no sharp lines; all degrees of susceptibility would be expected and even persons with rather moderate susceptibility might, under most trying conditions, become inebriates. It is probable that susceptibilities such as these are inherited, but not necessarily in a simple manner.

6

The variable tendencies toward allergies is another evidence of differences in the fundamental chemistries of individuals, as is also the fact that when different people react to an allergen they do so in variable ways.

Different species of animals tend to react differently toward allergy. Guinea pigs when made allergic characteristically show a reaction similar to asthma, dogs develop gastro-intestinal hemorrhages, while horses characteristically show urticaria (hives). Human beings when they develop allergies tend to react in one of the three ways, with some variations.

Many people have no tendency to become allergic to anything. Some become allergic to a certain few items and not to others. Some unfortunate people have a strong tendency to become allergic and react to many different articles of food, in which case their proper nutrition becomes a serious problem. There is evidence that the tendency toward allergy is inherited.

An allergic tendency may be considered an abnormal diseased condition and if we enlarge our discussion to include diseased conditions in general, many more examples of innate metabolic differences come to light. A considerable percentage of children are not susceptible to infection with scarlet fever due apparently to an inherited metabolic difference which persists. Negro children are relatively immune. There is also evidence that susceptibility to diphtheria, infantile paralysis and tuberculosis may be inherited. The same is true of cancer.

Diabetes, sickle-cell anemia, pernicious anemia, hemophilia and epilepsy are among the numerous diseases related to metabolism which are heritable. Their existence shows that individual metabolisms may vary not only within the normal, but may extend into the pathological range.

7

Investigation with respect to vitamins also throws light on the problem of variability in our fundamental metabolism.

In common with other organisms, even including lowly bacteria, we require in our food not only fuel to burn but other food constituents which make this burning possible. The numerous catalysts which we have mentioned as being concerned with metabolism must be built up in the body. Often they are built by using as raw materials specific vitamins and minerals, which must be in the food. If these are present in too small amounts the body suffers from malnutrition and various metabolic processes are impaired.

One of the ways of finding out about the intricacies of metabolism is to investigate the vitamins and how they work. If we can identify

a specific vitamin which is required by the body, there remains the problem of how it functions. If we could learn in detail how every vitamin does its work we should have gone a long way toward gaining a complete picture of metabolism.

The first vitamins were discovered by using experimental animals, often white rats, as "guinea pigs." Pure inbred strains of animals with a common inheritance have been used so that their growth rates and responses to particular food combinations would be as uniform as possible. In order to make valid comparisons between diets it is necessary to have several animals in each group and average their responses.

Tens of thousands of experiments of this kind have been carried out and a mass of information with regard to the nutritional requirements of the animals studied has accumulated. As knowledge has increased experiments have been extended to other animals: fowl, guinea pigs, mice, dogs, hogs, monkeys, etc. It is found that while the fundamental requirements are alike, they are by no means the same; each species has its own characteristics both with respect to the vitamins required and the amounts. Rats, for example, can produce their own ascorbic acid (vitamin C) and niacin and require no unusual raw material for their production. Human beings, however, can produce neither and are wholly dependent upon an outside supply.

Even within a single species of animals there are significant differences in requirements. On certain diets rats will usually develop rickets, but some rats are resistant and do not exhibit the symptoms. Even when the animals are inbred for generations and therefore have a heritage which is very much alike, this does not insure that the vitamin requirements of the individuals will be identical. It is partly for this reason that the average response of several animals must be used in any vitamin testing experiment.

Furthermore it has been possible, by breeding, to isolate from an inbred strain of rats two substrains of rats one of which has a higher thiamin requirement than the other. In other experiments selective breeding has isolated two substrains of rats one of which

required twice as much choline as the other. Similar experiments have been done with highly inbred white leghorn chickens. Substrains have been isolated which have different requirements for riboflavin.[7]

Vitamin experimentation on human beings has been relatively limited due not only to the expense and inconvenience involved but also because of the natural reaction against human experiments which might injure the subjects. Because of this and other difficulties, exact and dependable information regarding the amounts of the various vitamins which are required by human beings is scanty.

In dealing with a human population the problem is much more complex than in an animal colony, because inbred strains of animals have practically the same heritage, whereas human beings are extremely mixed up in their inheritance. On the basis of what we know about the requirements of animals it is safe to assume that individual human beings differ widely from one another in the amounts of different vitamins that they require. It is not at all improbable that specific individuals may have requirements for certain vitamins which are several times those of their associates. These differences may be due to relative failure to digest or assimilate, increased tendency to excrete, a failure in the ability to build the vitamins into the tissues, or to other reasons.

As I have said, information on variation in vitamin requirements is largely lacking; those who have been investigating vitamins in nutrition have not been interested in possible individual differences but have been pleased if they could get information about the average man and have been content to neglect the exceptional individual whose performances are out of line. Even information regarding the average man has been difficult to obtain.

Casual information suggesting individual variability in vitamin requirements is readily available. Probably every doctor who deals in his practice with vitamin requirements could cite cases of unusual benefits from vitamins, or cases in which administration of a vitamin was effective in one case and wholly ineffective in another. One of the most unusual cases which I know of is that of a woman

physician who found that to overcome eyestrain in herself she had to take continuously large doses of both vitamin A and thiamin. Lack of the latter vitamin has never been associated particularly with eye difficulties, though, like every other vitamin of the B family, it is essential for every tissue (including those involved in eyesight) and there is no theoretical reason why eye difficulties might not involve a large unsatisfied demand for it. Another exceptional case is that of a person whose hair started to turn from gray to black as the evident result of taking relatively large doses of thiamin for another purpose. Thiamin has never been thought of as an anti-gray hair vitamin. A deficiency of pantothenate, for example, will cause black-haired animals (and black-feathered chickens) to turn gray, and its administration will reverse the change. It has also been reported to restore hair color to human individuals who are gray, but the results are not uniform. The functioning of thiamin in this manner is exceptional and indicates an unusual metabolic quirk.

Various studies, which were not planned with this thought in mind, are nevertheless wholly in line with the idea that individuals may have distinctively different requirements. For example, it was recently found that several otherwise normal individuals continued to have a subnormal amount of vitamin A in the blood, and to show deficient dark adaptation even when they were given 200,000 units of vitamin A daily.[8] This is about forty times what is supposed to be the requirement of average individuals and the abnormal behavior is supposed to be associated with a deficiency of some other vitamin. Studies of the excretion of various B vitamins show that individuals vary widely in the amounts that they excrete when identical diets are used. In some cases this may be due to differences in the bacteria harbored in the intestinal tract. In any event, occasional examples of individuals who have unusually high or low requirements for thiamin and riboflavin have been reported. Some individuals absorb niacin (another vitamin) readily but others do not.

It would be presumed on the basis of what we know about the

inheritance of enzyme catalysts and the heritability of vitamin requirements in animals that the requirements for each vitamin would be inherited as a separate unit. A requirement for one vitamin might be very high, for another it might be low and for a third it might be about average and so on. The inheritance of individual vitamin requirements, which is closely akin to the inheritance of enzyme catalysts, does not rule out the fact that environmental conditions such as infectious disease may alter requirements and make for variation, though information on this point is largely lacking.

The best expedient for insuring oneself against all vitamin lack is to be careful in the selection of all food and allow a generous supply of all the vitamins. We can hope that by so doing the supply will be adequate whether our individual requirements are high or low. Actually, however, in individual cases we do not know how wide the spread in requirements is, and consequently have no adequate idea as to how far out of line our individual needs may be.

8

A large amount of evidence has been cited in the foregoing sections to show that each human being has a metabolic pattern which differs in numerous respects from that of his fellows. Since these metabolic differences are fundamental to our existence and to all our activities, it is important that the existence of these metabolic traits be recognized. Furthermore, before we can claim to be thoroughly acquainted with ourselves, we must know *how* our individual metabolic traits are distinctive.

The evidence bearing on the existence of these traits is concerned with the known inheritance of catalytic systems, recognizable metabolic traits of a gross and specific nature, evidence of individualities of metabolism based upon transplantation experiments, blood groups, analytical chemical studies, drug actions, allergies, metabolic diseases, and vitamin investigations.

From the standpoint of most of our social thinking, planning and legislating, we assume that all individuals can be lumped together into a single comprehensive group. We seek to force individuals in whether they belong or not. At a banquet we serve *everyone* coffee whether they wish it or not; in our attack on the liquor problem we try first the expedient of allowing *everyone* all the liquor their money will buy, then we seek to prohibit its use by *everyone*. We seek to find a rule regarding the possible harmfulness of the use of tobacco that will apply to *everyone*. In solving the problem of nutrition we have not yet progressed past the point where we think in terms of diets that are good for *everyone*.

This habit of thought when applied to numerous phases of our existence can lead into serious difficulties and has far-reaching consequences, some of which will be described in the following pages.

III. Sense of Sight and Social Behavior

Perhaps more lives are ruined through inability to deal with little everyday common things than for any other reason.

H. N. WEIMAN

JUST AS OUR DISCUSSION has shown that we require an understanding of various phases of our metabolism in order to deal adequately with ourselves as members of a society, so also it becomes clear that we require insight into the functioning of our special senses, the operation of which depends on metabolism. More than we realize, our sense of sight—what we see and when—influences our social behavior. While the general mechanism for seeing is the same for all of us, individuals do not see eye to eye either literally or figuratively and the differences which exist, though often inconspicuous, can by no means be neglected by those who wish to deal with human beings realistically—as they exist in actuality.

Science as it relates to vision has developed in two rather distinct directions. The underlying physical science of optics is highly developed through its various mathematical phases. The layman is not much interested in this but he is concerned with the application of optics to correcting the more common defects of vision. This necessarily is on a personalized basis—no one would think of trying to manufacture or sell spectacles that could be used indiscriminately by all members of the family; in fact, no reputable optician or optometrist sells glasses without due concern for each of the patient's two eyes.

There has been quite another approach to the study of vision—

that of the biochemist, physiologist, neurologist, and psychologist. These are interested in such matters as the microscopic anatomy of the retina—the rods and cones, etc.; the biochemistry of visual purple and the other pigments that function in vision, the neural pathways to the brain, the phenomenon of color vision, the electrical phenomena associated with vision, and a host of similar subjects. Such studies are also far advanced—though there is still plenty to learn—but since progress for the most part has been in the purely scientific aspects, there has been no development on a personalized basis, and 99 per cent of the investigations have been directed toward vision in the hypothetical generalized man and without regard to the individual differences between two sets of eyes. This impersonal approach is essential to the advancement of knowledge—on the other hand the advancement of our ability to deal with one another in society demands a better understanding of each other and to this end we must consider individuals.

2

If one is suspected of having a lesion in the occipital lobe of the brain, his physician will probably place him in front of an instrument known as a perimeter and plot the field of vision for each of his eyes. The size and shape of these plots will help the physician locate the exact site of the difficulty. But ordinary individuals who have not the distinction of a suspected brain injury seldom have this examination made.

There is a spot in the center of the normal retina which is, under ordinary light conditions, much more discriminatory than the rest of the retina. This spot, known as the fovea, is about the size of the period at the end of this sentence, is exposed more directly to light, and is endowed with elongated cones, whereas the rest of the retina is less exposed and has both rods and cones. If you look fixedly with one eye at the central i in the word illumination, you will note that even with your vision fixed on this letter the m and

n on either side are clear but that letters farther removed are indistinct. If you wish to see either end of the word clearly, you change the direction of your eyes. The image of the word illumination is too long to fall entirely upon the average fovea and if the eye is directed toward the center of the word, the image of the ends of it lap over upon the less sensitive part of the retina. These observations apply if your eyes are typical. There may be some variations in the exact responses.

In dim light the sensitivities are reversed. The fovea is less sensitive to dim light than the retinal area near by. Hence if one looks, preferably with one eye, directly at a dim star, it may disappear because the image has fallen on the fovea, which is less sensitive under these light conditions. If one directs one's gaze slightly away from the star's position, it may reappear.

All of our careful eye work is done using the fovea region. If we wish to scrutinize some object or some part thereof, we turn our eyes so as to bring the image of the portion to be scrutinized directly on the fovea. Peripheral vision, however, involves more than 99.9 per cent of the whole retina—all that outside the fovea—and is by no means unimportant.

The vision of individuals in this peripheral region is seldom studied (never in ordinary eye examinations) but it is possible, using a perimeter, of which there are several forms, to chart the field of vision and to show that in some individuals the field is more contracted than in others. The variations in the size of the visual field and in the sensitivity of the region outside the fovea of the field are responsible for the fact that some people are able to see and notice what is going on around them much better than others. When tests for peripheral vision were recently applied to 100 subjects selected at random their scores varied through the range 43 per cent to 364 per cent (average score set arbitrarily at 100 per cent). Excellence of peripheral vision was found to be independent of age, sex, color blindness, and central (fovea) vision acuteness.[1]

I remember a case in which I was extremely annoyed at a university colleague. I went to his office to see him and found him

talking to a student. Supposing that he would see me "out of the corner of his eye" and interrupt the conference, if necessary, I courteously waited for the interview to end. I waited and waited, thinking of course that he had seen me, but the conference about inconsequential matters went on and on. Finally, after a long period of waiting, I departed expecting to dispense entirely with the interview. Later somehow this colleague learned that I had been to see him and apologized quite sincerely for not having seen me. Having excellent peripheral vision myself, I did not fully appreciate that some people have more spacious "corners" in their eyes than others. I was judging his behavior on the assumption that his eyesight and mine were identical; it would have been utterly impossible for me to have missed seeing him under similar circumstances.

I venture that it is not uncommon for friendships to be dampened or for them to fail to develop because of poor peripheral vision in one person and good peripheral vision in the other. Where both have poor peripheral vision, probably no difficulty would arise on this score. Many seemingly little things can happen in case there is a marked difference: an unwarranted failure to speak on the street —a failure to make a necessary introduction at a social gathering— a failure to pick up signals when one tries to attract, unnoticeably, the attention of the other. If the two are riding together in an automobile, one will be able to read the street signs as they pass along; the other will not. One will see a wild animal which may suddenly appear and disappear along the side of the road, while the other probably will not. The person with poor peripheral vision cannot see anything at all clearly unless he is looking almost directly at it. In the case of the wild animal it is likely to disappear before he can "find it" by bringing its image to the central sensitive region of the retina. If the two persons are looking for an item in the newspaper, one will be able to find it in a fraction of the time that the other takes. If they play golf together, the one with poor peripheral vision may tend to be oblivious to what is going on around him, while the one who has excellent peripheral vision may

see too much of the happenings in his vicinity and be distracted—unnecessarily, from the standpoint of his companion.

The prevalent habit of thought which makes each individual consider himself normal and observe and judge everyone else in the light of his own supposed normality is pernicious and of far-reaching significance. Failure to appreciate differences of the kind we have been discussing, as well as mental differences which are just as acute, was responsible for the famous saying of Robert Owen as he severed his connection with his partner of many years, "All the world is queer save thee and me, and even thou art a little queer."

Careful tests for ability to detect movement (of an airplane) out of the corner of the eye showed that even among twenty-eight young men with 20-20 vision, the variability was so great that under exactly the same conditions the one with the best peripheral vision could see the plane's movement when its relative speed was only 2.15 miles per hour whereas for the one with the poorest peripheral vision, the relative speed had to be 90.95 miles per hour before its movement could be detected. It has also been found recently that young men meeting Air Force standards show wide variation in their ability to withstand the oxygen deficiency incident to flying at 10,000 feet altitude. Some show marked impairment of their peripheral vision, others do not. Some recover their peripheral vision immediately when the oxygen supply is abundant, others require days or even weeks to recover.[2]

While there are no data to substantiate the idea, it seems entirely probable that poorness of peripheral vision is an important factor involved in automobile accidents. In the case of pedestrian accidents poor peripheral vision on the part of either the pedestrians or drivers might contribute as well as general ignorance with regard to the wide differences that exist.

There is another reason in addition to those already suggested why peripheral vision should be measured and studied more intensively than it has. This is because of its potential value in the study of personality.[3]

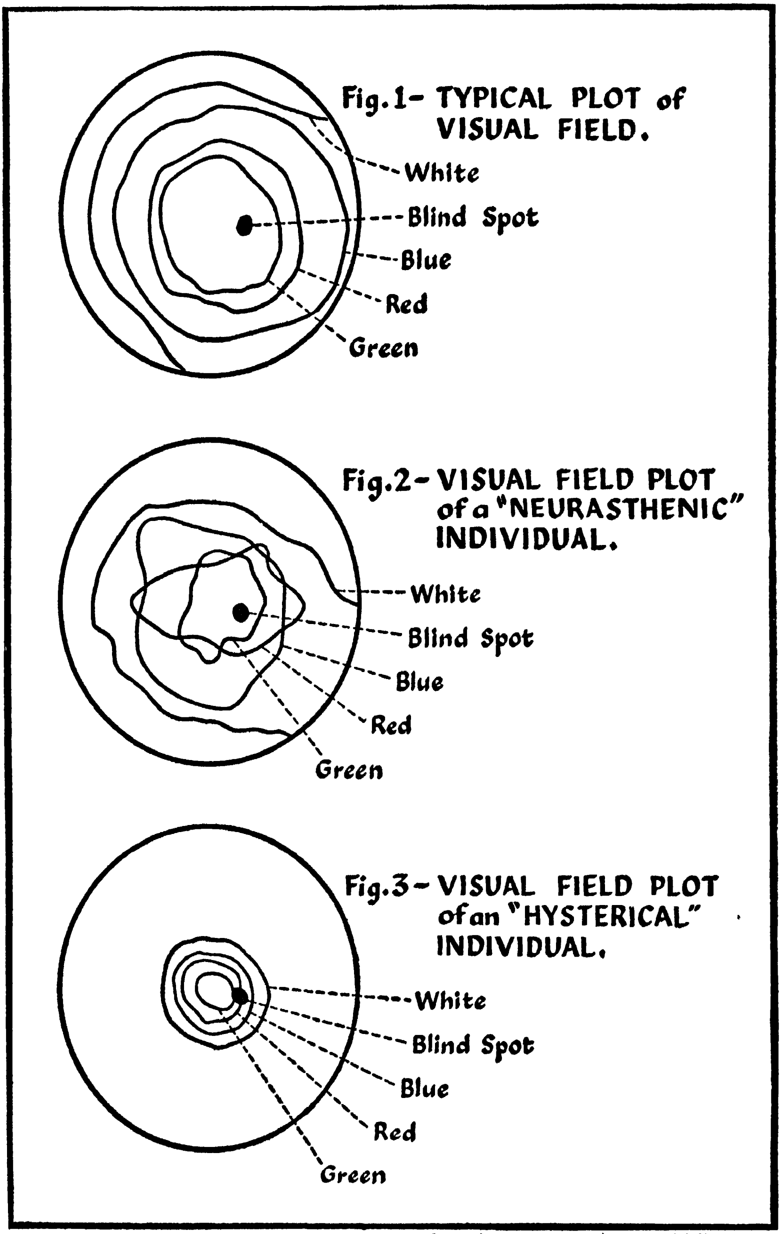
When the field of vision of a normal individual's eye is plotted it is found that when white light is used the field is largest; when the stimulus is a blue light the field of vision is roughly 25 per cent smaller in area. If red light is used the area is only about a third as large as with white light. With green light the area is smallest—about one fifth as large as with white light. The margins of the different color zones when plotted look, in a typical case, about like Figure 1.

For a "neurasthenic" individual a plot made in a similar manner looks very different, as shown in Figure 2. The zones are very irregular (and vary from time to time) and overlap each other. For a "hysterical" individual a plot made in the same way shows a highly contracted field of vision; that for white light is only about one sixth of the normal size (area). This is shown in Figure 3.

Psychologists nowadays agree, I believe, that the terms neurasthenic and hysterical, particularly when applied as designations for personality types, are not as meaningful as could be desired, because they are too complex and cover too many variable factors. The significance of various types of field-of-vision charts in terms of psychological traits has not been sufficiently investigated so that the charts can be interpreted. It is very interesting that such wide differences exist between individuals and this appears to be a powerful tool in the investigation of personality differences. People have always wanted to be able to peek into other people's minds and to see the happenings there. Visual field charting will not do this, obviously—yet it is a new way of getting a clue and science gets somewhere when it follows clues.

3

Another complicated set of vision characteristics in which we may have marked differences comes into play in viewing moving pictures. It has to do with the phenomenon of flicker fusion. When light of a given intensity is flashed off and on periodically, the eye



From VISUAL FIELD CHARTING, *by Thomas G. Atkinson, M.D., copyright 1941, reproduced by permission of The Professional Press, Inc.*

may be able to see the flickering, but if the speed of the flashing is increased, there comes a point where the light seems to be continuous. This is called the critical flicker frequency and the underlying phenomenon is made use of in motion pictures. The image of one picture persists until a new one is presented.

There are numerous factors which influence the critical flicker frequency. The light intensity is an important one. If a very dim light is involved, as few as three or four flickers per second may be enough to cause the light to appear continuous. On the other hand, if the light is very bright over fifty flashes per second are required. In this behavior the right and left eyes of an individual do not behave alike; both eyes together act somewhat differently from either one alone, and the response of the fovea region is different from that of the rest of the retina. The wave length (color) of the light used is another factor.

These and related phenomena, which are obviously complex, probably are the basis for the fact that some people are tired excessively by motion pictures, and some prefer to sit in the rear while others prefer being further toward the front of the theater. Since the intensity of the light striking the eye varies inversely with the square of the distance to the screen, the difference between the back and the front of a theater can be very great, and if the illumination at one distance is most suitable for a particular pair of eyes, the other distances will be relatively unsuitable. Since light intensity has a marked effect on the response to flicker phenomenon, it seems entirely reasonable that certain individuals should have trouble under conditions which exist in theaters.

For guidance in the production of moving pictures, those in charge of technical aspects have necessarily had to depend, for scientific insight, on scientists who have been engaged in studying the characteristics of the average statistical man and not the characteristics and idiosyncrasies of actual people. Moving pictures have been designed from the engineering standpoint essentially to be shown to an audience made up of like people. Probably much nervous energy could be conserved if individual differences were

studied and an attempt were made to adapt the theaters and the physical presentation, as far as possible, so as to meet these differences. In order to make the entertainment attractive to more people, it may be necessary to increase the factors of safety so that even those with eyes that are far from normal (with respect to flicker fusion, etc.) can get the full benefits.

4

A wholly new eye complication which is responsible for eyestrain in an unknown but large number of people was discovered a few years ago at the Dartmouth Eye Institute. The condition, known as aniseikonia, is of obscure origin but involves primarily the working together of the two eyes—the images thrown upon the two retinas do not correspond perfectly. Difficulty is encountered particularly in those who have acute vision. Such an individual may be able to see with extraordinary acuteness, yet the use of the eyes may entail so much strain that extensive use is impossible. Trouble of this sort may arise through the use of the eyes either for close work or for distance or for both.

It is well recognized how difficulties in eyesight on the part of a school child may cause endless trouble and that a bright child may be made backward and his whole social world changed because of this defect. The same factors enter into the life of adults—an individual who cannot read extensively because of eyestrain may appear very "different" to his associates; he cannot read for diversion and must obtain a substantial part of his recreation in some other way. He may have difficulty in keeping up with the world around him and his whole social outlook may be altered.

The condition of aniseikonia may be responsible for remarkable paradoxes and for a failure of people to understand each other. One person may have such poor vision (near-sightedness) that even with glasses he cannot recognize his best friend across the street, yet he may be able to sit down after supper with his books and read all

night long with no eyestrain whatever. Another individual may have remarkably acute vision—may be able to read small lettering at great distances or the tiniest print close up—and yet if he suffers severely from aniseikonia, his eyes become exhausted if he uses them one-twentieth as long as his near-sighted acquaintance.

5

Since the advent of fluorescent lighting with its tremendous advantage of economical power consumption, there have been numerous complaints of eyestrain allegedly caused by this type of illumination. The developments will be interesting to watch because as a result the attention of lighting experts may ultimately be called in a forceful way to the wide variability which exists in the eyes of individual people.

It is reported that ophthalmologists and optometrists in the Pacific Northwest indicate that one-fifth to one-third of all the patients who come to see them say that they first noticed eyestrain when they began working under fluorescent lighting. One optometrist on the basis of careful records estimates that 20 per cent of his practice is concerned with treating "fluorescent light trouble." This is not a local problem, and it has been of concern to manufacturers of lighting equipment.[4]

Many illumination engineers are of the opinion that the difficulties incident to the use of fluorescent lights are based upon violations of the principles of good lighting and are not due to any inherent defect of the fluorescent light itself. The light is of a pulsating character and when a single tube is used an annoying flicker may be observed if there is movement in the field of vision. It is claimed that the use of double tubes eliminates this difficulty. There are indications that the regular or white tubes are less likely to cause complaint than are the daylight tubes.

It is not surprising, in view of the attitude of many physiologists and physiological psychologists, upon whom engineers must depend,

that practically every writer on the subject of illuminating engineering should assume that lighting which is adapted to *the human eye,* is all that can be desired. This assumption is unwarranted because it has long been known that people vary greatly with respect to their demands: some like a bright light shining on their books, others much prefer diffuse light; some find eyeshades of great value, others are indifferent to extraneous lights in the visual field unless they are very bright. We are badly in need of more definite information with respect to eye variability. Particularly in the field of fluorescent lighting it would be desirable to know how variable eyes are in their ability to tolerate pulsation or flicker, whether noticeable or not, without fatigue.

The seeing process involves a great deal more than optical physics. There is so much obscure biochemistry, biophysics, physiology and psychology involved, that it is not feasible for an engineer to theorize successfully on the basis of optical principles regarding whether or not a particular type of light will cause fatigue. The proof of the pudding is in the eating.

Many observations in addition to those already cited suggest that individual variability is important in connection with fluorescent lighting. For example, individuals often have strong likes and dislikes with respect to this type of illumination, as it has been used. I have known of several cases, some relatively mild and others severe, in which individuals appeared to be adversely affected by fluorescent lights. Thorough investigation of individual complaints —even exaggerated cases—might be very worth while from the standpoint of throwing light upon less serious difficulties that others may experience. I am confident that the engineering profession can meet the needs once they are fully known.

6

Individual eyesights differ one from another in a large number of ways. Adaptation of eyes to darkness and to light varies with individuals and is important, particularly in connection with driving

automobiles at night. The situation is not as simple as is often supposed by those who think that eating carrots (containing vitamin A) is bound to help. It will do so only if the difficulty is due to vitamin deficiency. There are many complications, including one type of night blindness, hemeralopia, which is not brought about by vitamin A deficiency. The problem of the relation of vitamins to eyesight is closely related to the problem of variability of vitamin requirements in general.

Color blindness, which may exist in several forms and in different degrees, is another eye condition which is of social importance. As far as it relates to the reception of signals, particularly red and green lights, its importance has been recognized for many years. In detecting and eliminating color-blind people from occupations where their presence would be a hazard the problem has been relatively well solved, but in our knowledge of this subject there are many refinements which are of some social significance. These will be evident in later discussions.

Sensitiveness to light is an item separate from other eye difficulties. An individual may have a great deal of difficulty with the general use of his eyes but may have no trouble with glare or with relatively strong illumination in a sleeping room. On the other hand another individual may have a very serviceable pair of eyes in general, but may be bothered by glare excessively or may have difficulty, for example, in going to sleep in a room where there is even a dim light. For the use of the latter sort, special blinders are on the market. Possibly the differences are due in part to differences in sensitiveness to particular critical wave lengths of light, including the ultra-violet, though it appears that with certain people visible light in any form registers on their nervous systems to a degree that it does not in others.

Obviously in the process of using the eyes there is a tremendous amount of movement, not only in constantly shifting the eyes so that the desired image is brought to the fovea, but also in the act of accommodation and in the changing of the size of the pupil. It seems equally obvious that the different structures concerned will vary in individuals just as do our other anatomical features: teeth,

noses, fingers and even fingerprints, and that limitations imposed upon the use of any particular pair of eyes will depend upon the characteristics of these structures. Where muscular difficulties exist and predominate, many people have been benefited by exercises which strengthen the deficient muscles. Some become so enthusiastic about their pet measures that they decry all use of spectacles.

The process of reading is one of great complexity, embracing not only the visual process, involved and extensive muscular actions, but also the activity of the central nervous system. Some people will be limited in their reading efficiency by one type of weakness and another by another, so that one would not expect any particular formula for learning how to read effectively to be equally valuable for all persons. Neither should we expect everyone to possess the same capabilities for rapid reading, any more than we should expect every person to be capable of running the hundred-yard-dash in ten seconds. The anatomical and physiological differences between different sets of eyes are less familiar—but none the less real and important—than the dissimilarities in the lengths of two individuals' legs, or any other gross variance.

Many differences in opinion with regard to the way eyes should be treated are probably due to bias based upon personal experience. Seeing is believing and if a person knows that a particular line of treatment has benefited him there is a strong temptation to believe that it will benefit anyone. If he promotes his particular type of treatment as a panacea he may find others in sufficient numbers who respond in the same way, so that a fad with some substantial basis is started.

A very minor physiological difference can cause conflict in social behavior. For example, I played golf on a rather raw and windy afternoon with a couple of young army officers. One of them, a big husky, was having considerable difficulty. Finally, after missing a shot, he remarked, "That wind makes the tears come to my eyes so I can't see the ball," which caused his partner, whose eyes were unaffected, to rib him cheerfully about the quality of his alibi. The facts are of course that the tear glands of different individuals vary

greatly in their tendency toward activity. I watched the husky soldier thereafter and it was plain that the watering of his eyes was giving him a lot of trouble, while his partner was perfectly dry-eyed. We learn from childhood to think of ourselves as normal and to judge others accordingly. Consciously or unconsciously we say to ourselves, "This other fellow is just another such as myself. If he appears to be bothered by wind or glare when I am not, it must be a pretense—he is letting his imagination play tricks on him."

The ability to judge distances and angles is related to the sense of sight and to visual memory, and comes into play in numerous mechanical trades and industrial operations as well as in many games and sports. The relationships between these abilities and others need investigating. It is probable that such abilities are based to a considerable degree upon inheritance since some individuals cannot be trained to be proficient. It would probably be possible to devise a series of tests which would determine in advance whether a person had the fundamental abilities necessary to make a good billiard or golf player. Provisional tests could be tried out on accomplished sportsmen in these fields and their validity determined. People who can never learn to play such games, because of inherent limitations involving eyesight, would be helped in their mental health if they could know it in advance and spend their energies on some other form of diversion.

7

Another set of measurable abilities which depend on eyesight and in which individuals differ greatly is related to the ability to judge and appreciate esthetic design. This is something which is apparently innate and not the result of training. Some people have a "feel" for it, others do not. There are all degrees of sensitiveness but there is a fundamental consistency and agreement among those who have a flair for this element in art.

Maitland Graves has developed an excellent series of tests which

can be used to determine the extent to which one possesses this taste. A series of twenty pairs of designs are presented and the subject is asked to choose the better design in each of the twenty pairs. One of the advantages of this particular test is that the designs do not resemble in appearance actual objects and hence are free from a host of pleasant or unpleasant associations which might influence one's decision, quite apart from the designs themselves. It has been used in various art schools for entrance examinations and for other purposes.[5]

Different individuals show a wide variation in response to this test. Some without previous art training will consistently pick in every case the design which experts agree is the better of the two. Others will choose the correct one in a large percentage of cases but will miss a few. Since the choice is between two designs in each case, pure chance would allow a 50 per cent score if one used no discrimination whatever. Actually some laymen as well as prospective art students have scored less than 50 per cent, which probably means the possession of substantially no taste in this regard rather than the possession of taste which is positively bad. Two of the easier pairs of choices are reproduced with permission in Figure 4. The designs on the right are superior in each case.

The appreciation of design which an individual possesses determines to a large extent the taste of the individual with respect to forms in architecture, in sculpture and art, in house furnishing, in the selection of clothing, coiffure and make-up.

Closely related but probably more complex is the appreciation of color with its characteristic qualities and its numerous combinations. Colors themselves have been studied and catalogued very successfully on the basis of possessing three dimensions: hue, value and chroma. Red and green differ in hue; red and pink differ in value; strong red and grayish red differ in chroma. Sensitiveness to colors and their interrelations is not concerned with design and individuals do not necessarily possess an aptitude toward these two elements of art in the same degree. One may be highly sensitive to form but relatively indifferent and undiscriminating as to color, and vice

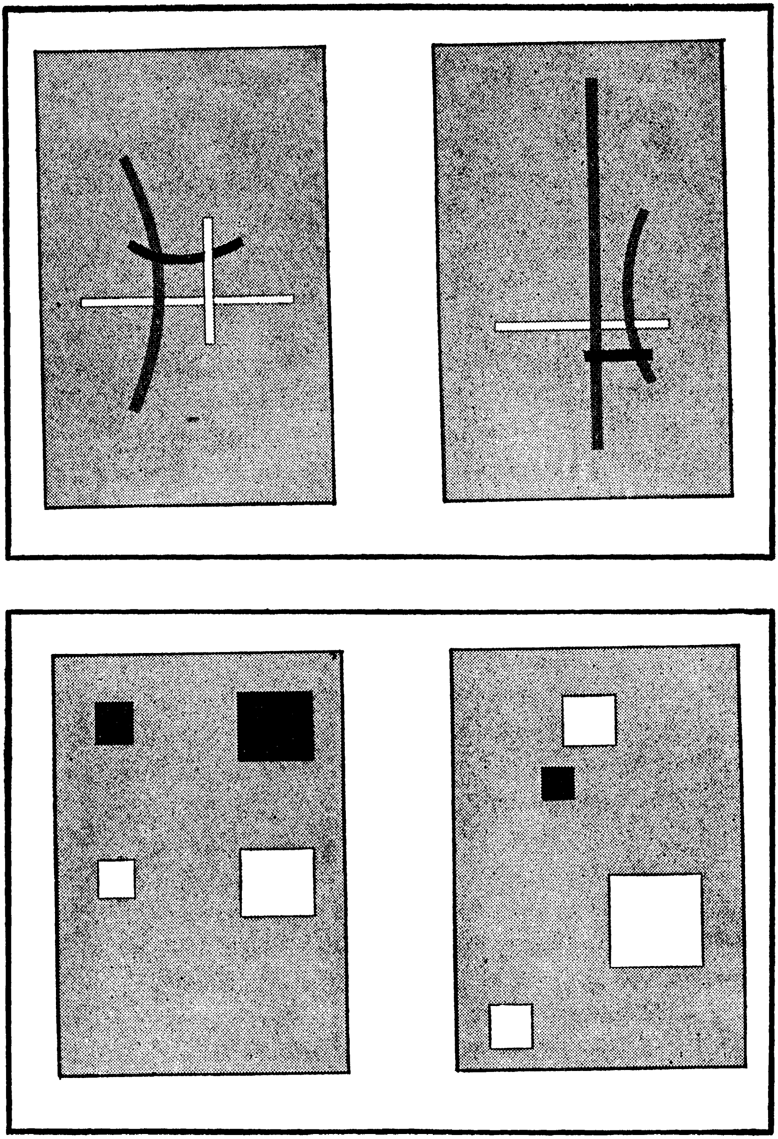


Fig. 4 – WHICH ARE THE BETTER DESIGNS?

From THE ART OF COLOR AND DESIGN, *by Maitland Graves, copyright 1941, reproduced by permission of McGraw-Hill Book Company, Inc.*

versa. A single pure color such as red has something of the same effect on different individuals—it may accelerate pulse rate and raise blood pressure while blue may have the opposite effect—but some individuals will be unusually sensitive and others will be relatively indifferent. One man may be thrilled with delight at a colorful sunset while another may not give it a second's thought. Presumably sensitiveness to color and taste for color combinations go together to some extent, though adequate tests are not available to settle the question.

Appreciation of the beautiful relies, so far as vision is concerned, on sensitiveness to form and design on the one hand and color and color harmony on the other. This is by no means something for artists alone. Presumably works of art are produced not for the sake of other artists but for the population as a whole. Much art of one kind or another enters into the building and furnishing of every home.

These susceptibilities which we possess in a multitude of shades are of moment in connection with the human problem of living together. How much taste has to do with happiness or unhappiness in marriage is difficult to say, but no one will deny that common tastes constitute an important tie between husband and wife, and yet we enter into marriage knowing little about the capacities or the taste of either our spouse or ourselves. If after marriage the tastes are found to be entirely different, the parties to the marriage contract have difficulty in adapting themselves and often must find outlets for their enthusiasms separately.

It can scarcely be denied that taste for form, design, and color are elements which enter into the complex thing we call personality. A scientific approach to the study of personality would certainly involve an evaluation of all the measurable elements which enter into it, and the factors which we have been discussing should be included. The various elements which may be concerned with the total personality may be numerous and of diverse character. Rudimentary attempts to measure personality have been made on a wholesale basis without appreciation of the different types of

factors involved. Hay, hardware, and handkerchiefs cannot be measured together by the bushel, by the ton, or by the yard.

It is worth noting that responsiveness to design or to color harmony is one thing, while creative ability in the field of art may be quite another. Certainly one could not be creative without being appreciative of one's own medium, but it appears that people may be highly appreciative without having any marked degree of skill or gift of originality. I suppose those who are unsympathetic toward more bizarre forms of art could argue that the artists who produce such may actually be endowed with originality but not with good taste. Since good taste is not confined within rigid limits, I would prefer a more tolerant attitude.

8

Probably closely related to design sensitiveness, color sensitiveness, or even to visual acuity is the tendency toward visual imagery and visual memory. For some people the sense of sight predominates over the other senses so far as the exercise of imagination or memory is concerned. If they *see* something, it impresses itself most forcefully and is remembered easily as a consequence. To such people all sorts of visual devices, pictures, charts, models, etc., constitute an effective means of conveying impressions. People possessing a capacity for spatial imagery can comprehend and interpret complicated geometrical figures. It is impossible to look carefully at more than a very small part of a complicated diagram or model at one time because the sensitive fovea area in the retina is very small. To grasp the significance of the whole various parts must be held in the "mind's eye" until an accumulated image of the whole registers. People who do not possess this capacity for visual imagery and memory are helpless in comprehending complicated diagrams or the mechanisms which they may represent.

The possession or non-possession of such ability influences an individual's competence not only in a great variety of occupations,

trades and professions but also in recreational activities. Obviously a person who can plan a chess game in his imagination has the tendency toward spatial imagery and memory to a relatively high degree and will be proficient in activities that bring this ability into play. Clearly people can understand each other better if their abilities in this regard are not too far different, and misunderstandings can be avoided by the recognition of wide differences when they exist.

From the standpoint of education the degree of visual mindedness in individuals is highly important. Yet our educational system has not developed to the point where the teacher knows the extent to which he himself or the students under his guidance are visually minded; they are all taught in the same manner regardless of their ability to take it. The application of cold science to this situation would point to the relative ineffectiveness of attempting to educate a person without knowing in advance the important avenues through which impressions readily come to him. It would seem probable that a predominantly visually minded teacher might be highly effective with visually minded students, while others might find him boring. As long as education must be carried out with large run-of-the-mill classes, there is a presumption in favor of the teacher who is capable of utilizing different modes of approach and does not have an exaggerated tendency in one direction or another.

9

We have noted a considerable number of factors associated with eyesight—peripheral vision, flicker fusion, aniseikonia, response to special types of illumination, ability to judge angles and distances, appreciation of design and color, visual imagery and imagination, and several others. In each one individuality is readily observed and many of them are highly important in social contacts, because they enter into everyday living in many forms of work and play.

Only a non-scientific or a superficial approach to a study of hu-

man beings could neglect these factors; they are important in making us what we are. The individual differences with respect to eyesight which are readily observed are intimately associated with anatomical and physiological differences existing in the eyes. The functioning of the eyes and their maintenance in a state of efficiency is a part of metabolism. This is emphasized, for example, by the effects of lack of oxygen (for combustion purposes) on peripheral vision. Metabolism in our eyes is distinctive, like that in other portions of the body, and is affected by metabolic happenings elsewhere in the body.

One of the tasks of humanics will be to learn more about eyesight differences and how they may be correlated with each other, with general metabolic differences and also with other physiological and psychological factors which enter into every personality. Out of this knowledge will arise increased appreciation of each other and increased expertness in our relations with one another. We will come to order affairs more and more so that each individual can feel at home in a society that has at least made a sincere effort to adapt itself to his distinctive capabilities and needs. In order to accomplish this end, we must know human beings in relation to every phase of their existence.

IV. Traits Based on Other Senses

Evidence is thus given . . . that different people live in different worlds, so far as their sensory reactions are concerned.

A. F. BLAKESLEE

JUST AS SOME INDIVIDUALS are particularly sensitive to light and glare, others are especially sensitive to noise. It is questionable whether there is anyone who does not enjoy a certain degree of quiet.

Extreme sensitiveness to noise exists in comparatively few. Noise abatement movements find only a few enthusiastic supporters, and questionnaires circulated in urban populations indicate much indifference. For the majority, barking dogs, clanging streetcars, crying infants, honking automobiles, blaring radios, etc., are not annoying and do not disturb sleep or mental activity unless they are close by. But there are those who are greatly annoyed by these and many less compelling noises. They find it difficult or impossible to ignore a dripping faucet in an adjoining bathroom or the ticking of a watch under the pillow. There are at least five places in this country where ear stopples which people may wear to dull the noise are manufactured. The demand for such devices, however, is comparatively small. It is said that Mussolini in his prime was sensitive to noise and to avoid personal disquiet ordered automobile horns in all Italy to be stilled. As a result taxi drivers and others had to keep closer watch and could not depend on sounding their horns to warn their possible victims. We were told in Florence that the accident rate was markedly reduced by Mussolini's order.

People's conduct in moving picture theaters particularly, where they are relatively uninhibited because of the darkness, reflects their attitude toward noise. The eating of popcorn especially out of crinkly bags is a first-rate annoyance to those who are sensitive, second only to a continual flow of partly audible conversation. Experiments have shown that so far as disturbing mental effort is concerned talking which can be partly understood is most effective.

Whether sensitiveness to noise is closely associated with acuity of hearing has never been adequately investigated. It is certain that the same auditory stimulus may make more of an impression on one individual than upon another. A particular person may be peculiarly susceptible to a specific noise—for example, the screeching of a piece of chalk scraped along a blackboard. He or she may feel like screaming when this noise occurs. Another individual may be indifferent to this sound, but may react violently against another noise, the creaking of a rusty hinge or the shrilling of a high-pitched whistle. These variations are probably due to anatomical features in which one set of hearing organs is built to receive and register with especial effectiveness certain specific vibration frequencies. It is well known that our middle and inner ears differ from those of our neighbors to the same degree that our external ears do. The auditory and nervous set-up is by no means the same in any two individuals. However, several studies in industrial plants have shown that the output of employees in general can be significantly increased by reducing the volume of noise to which they are subjected.

Aside from understanding each other better and avoiding unnecessary annoyance and waste of nervous energy there is another reason why it would be desirable to know more about auditory sensitiveness. There is probably a correlation between insensitiveness to noise and a tendency to be noisy. If this is true and we were conscious of the fact that loud-mouthed people are that way because of a physiological insensitivity to noise, it would have a tendency to make us more charitable, just as we are to a deaf person who talks loudly. The difference between a partially deaf person and one who

is insensitive to noise is that the insensitive person is able to hear noises normally but the noises do not impress themselves upon his nervous system or demand his attention.

2

Another set of human traits that are associated with the sense of hearing center in our reactions to music. Being musical is not by any means a single trait, as Seashore's investigations have shown. Instead there are a number of separable elements which enter into the aptitude for music. Those which can be measured most adequately are (1) sense of pitch, (2) sense of tonal intensity, (3) sense of musical timing, (4) sense of consonance, and (5) tonal memory. Each of these can be measured separately and the possession of one element in high degree does not indicate competence with respect to the others.[1]

Among a series of students applying for admission to a school of music, individuals were found who would have high scores in most of the tests but would be relatively low in some. Others might be low in several but be relatively high in others. Variations among the general population would be greater than among these prospective music students, because all of the prospective music students were, it is presumed, somewhat musically inclined. Here are the test scores (centile ranks) of individual prospective students who on the basis of the tests were classified among five groups:

Centile Ranks of Prospective Music Students

Student	*No. 1* (*safe*)	*No. 2* (*probable*)	*No. 3* (*possible*)	*No. 4* (*doubtful*)	*No. 5* (*to be discouraged*)
Pitch	95	82	62	45	2
Intensity	91	84	15	27	25
Timing	93	86	72	15	12
Consonance	99	94	78	56	56
Tonal memory	98	55	62	48	32
Imagery	78	99	55	82	36

Student No. 1 whose scores are given in the first column was clearly outstanding in the group with respect to these tests, yet in imagery his score is much below No. 2 and even below No. 4 who was placed in the doubtful class. It may be noted that No. 2 is weak in tonal memory and very strong in imagery, whereas No. 3 is very low in intensity and No. 4 is strong in imagery. Even No. 5 rates higher in consonance than did No. 2 in tonal memory.

If tests for these factors which enter into musical aptitude are satisfactorily given to an individual, subsequent tests will yield very nearly the same results. Even with children camparatively little change takes place as they mature, and tests given adults before and after three years of intensive musical education yield practically the same results. There is every evidence that these various capabilities are specific endowments and that each of us is born with a distinctive assortment.

A study made by Alec Washco, Jr., at Temple University makes it appear that, aside from the musical elements cited there is a separate emotional element which can be measured by means of the effect of music on the pulse rate and blood pressure. He found that certain types of music as exemplified by "Serenade" from Puccini's *Madame Butterfly* and "Invitation to the Dance" by Von Weber, consistently tended to lower pulse rates and blood pressures in a large group of individuals, but that other music, for example Sousa's march, "Stars and Stripes," and Gershwin's "Rhapsody in Blue," tended to increase pulse rates and blood pressure. Individuals showed considerable variation but the study was of a group. One's emotional response to music might be measured by this means, it would seem, giving another item in musical aptitude. Mechanical perfection may conceivably be attained and yet the performer may not be able to "pluck at the heartstrings" of his audience.[2]

Even eminent musicians do not possess every element to a high degree. Seashore mentions a distinguished singer who was found to be deficient in such an important matter as pitch discrimination. She failed in various types of performance for this reason but by chance hit upon folk songs in which she appeared in solos and

where she could make use of artistic liberties not uncommon in folk songs. She had a beautiful voice with wide compass, and the great advantage of a graceful body and a beautiful face. In spite of her deficiency she was highly successful. Seashore says, "Persons who lack sense of time or a sense of intensity are common in musical circles. The relative absence of feeling, imagination or intellect in persons who have attained distinction in music is a notorious phenomenon."

Musical taste as well as ability to perform is doubtless determined by one's possession of elementary abilities. Those who have a keen sense of rhythm will be attracted to music in which this feature is important, and those possessing an excellent sense of consonance will be appreciative of music in which harmony plays an important part. These are among the important factors which determine one's musical taste. People's tastes differ even violently at times but these differences are based upon fundamental physiological and psychological dissimilarities. We should not expect everyone else to have the same musical likes that we have, nor should we be so certain that our taste is good and that whatever differs from it is bad taste. Made up as human beings are, how can the reactions of all be the same?

From the standpoint of our understanding of the peoples of the world it would be helpful if we knew more about the roots of musical taste and how races differ with respect to possession of the different features of musical aptitude. A knowledge of how musical tastes are related to other capabilities would be useful, since we may suspect that an individual's general character and his musical taste, or lack of it, are somehow related. Famous musicians have often been emotional. Not infrequently they have often been highly sexed and sensual, and there may be some connection between their musical leanings and their other traits. Nero, who was devoted to music and poetry, was extremely sensual and was many times a murderer, so interest in music is no guarantee against the possession of other less desirable traits. But there are different types of musical taste and it seems unlikely that two individuals should have practically the

same musical tastes and be wholly different with respect to their other likes and dislikes. If we knew enough about it, musical aptitudes might be used as one basis for judging character.

Creativeness in music, as in art, may be an independent possession though, as a matter of fact, most famous instrumental performers have also been composers. Famous singers have not commonly been composers; presumably the one essential gift of singers is the voice, and having this they need not excel in other departments of musicianship.

Probably the same factors which enter into musical taste also tend to determine our attitudes toward the voices of others. I have known of individuals who when asked the reason for their vote in a political race would simply reply that they disliked the voice of the opposition candidate. Such an individual would presumably be highly sensitive to auditory stimuli. Psychological experiments have indicated that something in the way of character reading can be accomplished simply by hearing the voice of the individual. It is well established that human voices differ from each other; presumably the anatomy of each set of vocal cords and the associated air passages is distinctive, and the habits with respect to the use of the voice may also differ.

3

The sense of balance and all the phenomena related to it are dependent largely upon the functioning of the semi-circular canals in the inner ear, and it is to be expected that we differ one from another in respect to these structures and their functioning. Some people are naturally good sailors and others have a poorly developed resistance to motion and readily become seasick, airsick, or carsick. I suppose it is natural for people who are resistant to this trouble to look with condescension on poor creatures who are not, but since the difficulty has an anatomical basis there is no justification for thinking of such persons as sissies unless it should be demonstrated

that difficulties of this sort are associated with other characteristics which we wish to label in this way.

Another interesting manner in which people differ is in their sense of direction. Some carry with them a *feeling* of orientation. Whether they are correct or not, they continuously have a feeling as to which direction, for example, is north. This intuitive sense is so far from infallible that it may reverse itself as one moves from one side of a train or ship to the other. Others have no such intuitive idea and must see the rising sun or some other orienting object before they can get their bearings.

There are people who have continuously a dependable idea of orientation to a much greater degree than others. How many of my readers can, from where they sit, point immediately in the direction of New York City, San Francisco, or Havana, Cuba? How many can do the same after taking an elevator in a large office building and entering an office where they have never been before? How many, sitting in their homes, will describe in gestures the act of entering a building or turning a street corner in the downtown district, with complete disregard of the correctness or incorrectness of the orientation of their gestures?

It seems most likely that these differences are based in part upon what we may call directional memory, which like visual memory or auditory memory is of a different degree of refinement in each of us. Presumably for some people turning a corner registers and is retained in their subconscious memory so that they tend to keep their orientation except under difficult conditions involving a large number of turnings. For others this directional memory is comparatively weak.

The directional sense of migrating birds may be due to highly refined directional memory. If we imagine that every turn of their bodies registers on their psychological make-up, then their orientation would always be maintained. This may be parallel to the possession of what is called absolute pitch by a human individual. An individual possessing this ability can remember accurately what middle C sounds like and can reproduce it or other pitches at will.

Incidentally, birds and animals sometimes exhibit behavior that indicates they may possess something related to absolute pitch. I have repeatedly noted that the most prominent note in the song of cooing doves is a fraction of a tone below the C above middle C on the piano. An interesting case was observed in the Museum of Natural History in New York; an alligator, Oscar, was found to possess, in a sense, absolute pitch. He responded with a vociferous bellow whenever B flat two octaves below middle C was played either on a French horn or on a cello. Other tones elicited no response.

Auditory memory is well developed in some and poorly developed in others. It is sometimes said that about three-fourths of all human beings are eye-minded and about one-fourth ear-minded. This is a very crude approximation to the truth because there are different senses in which these terms can be used and diverse degrees of each condition. Furthermore, it is questionable whether one condition precludes the other. Probably some people who might be classed as ear-minded are nevertheless more sensitive to visual stimuli than others who may be classed as eye-minded. There are probably innumerable degrees to which both types of capabilities exist either together or separately.

All phenomena related to hearing are of course dependent upon the possession of the hearing sense. Deafness exists in all degrees. In the case of those whose nervous systems make them easily distracted by noise, this may not be a disadvantage. Edison is reputed to have said that his deafness was not an unalleviated handicap since it allowed him to concentrate.

It is interesting that many of us may be deaf or partially so for a given frequency of vibration without our hearing for other frequencies being impaired. Such deaf spots are not uncommon but may go undetected. I know of an individual who has generally acute hearing in both ears, but in one ear only is practically deaf to the noise of crickets. Tonal dips occurring within particular vibration frequencies, where hearing is considerably less acute than average,

have been found in 15 per cent of boys examined and in only 5 per cent of the girls.[3] As we age, our hearing, so far as the higher pitches are concerned, diminishes markedly.

4

Variations in the sense of taste can readily be observed not only in connection with specific taste stimuli but also in people's attitudes toward eating in general. Gustatory stimuli, like visual or auditory stimuli, make much more of an impression on some individuals than others, and it is not surprising therefore that for some people eating is one of the keenest delights they experience whereas for others it is merely a mildly pleasurable routine.

An experience in a chemical laboratory first called my attention to the potential importance of differences in taste. A white crystalline substance was submitted to me for identification. Its origin and its general properties suggested that it might be creatine, an important muscle constituent. However, my assistant and I both tasted the substance and found it to be tasteless like chalk, whereas creatine was described as a "bitter, biting substance." In spite of this contrary evidence, further study led us to conclude positively that the substance must be creatine. Before committing ourselves, however, we submitted it to other people to taste. The fourth person to whom it was submitted pronounced it bitter.[4] One interesting feature about this observation is the fact that creatine is a relatively abundant constituent of muscle (meat) and is readily extracted from it in the preparation of soups or gravies. In view of the observation cited, it would indeed be surprising if soups and gravies should taste alike to people regardless of whether creatine is for them tasteless or bitter. A child might readily be misunderstood and a dislike for a soup might be based upon its creatine content and not upon imagination or cussedness as the parent may imagine. There is the possibility, of course, that the taste of creatine (which by itself has been described as bitter) when blended with the other flavors, en-

hances rather than detracts from the taste appeal of a meat or soup. It is difficult to imagine that in these practical situations its effect would be negligible or the same for all individuals.

The ability to taste creatine has not been investigated from the standpoint of heredity but the ability to taste another chemical, phenyl thiocarbamide, has been found to be inherited. For the majority of people this substance is bitter but for a substantial minority it is tasteless. The inability to taste phenyl thiocarbamide and closely related substances is inherited as a recessive trait. Further analysis revealed, however, that even those who detect the bitter taste differ greatly in the concentration required to produce this effect and even the non-tasters were able to taste it if a solution of high enough concentration could be applied to the taste buds. The ability to taste this particular substance was found definitely not to be associated with an otherwise keen taste. A non-taster might be able to detect other substances in low concentration, and one who was able to detect phenyl thiocarbamide very readily might be relatively unresponsive to other tastes. There is a strong presumption that the ability to taste creatine is inherited like the ability to taste phenyl thiocarbamide.

Blakeslee investigated the response of 6,377 people to a moderately concentrated solution of phenyl thiocarbamide, and found that 21.3 per cent pronounced it tasteless, 65.4 per cent said it was bitter, 5.4 per cent indicated that it was sour, 2.1 per cent said sweet, 4.8 per cent said salty, and the remaining 1.9 per cent ascribed to it miscellaneous other tastes: "astringent," "like lemons," "like rhubarb," "like cranberries," "like vinegar."[5]

In a more intensive study of the taste thresholds of forty-seven individuals he found that the thresholds and responses vary not only for the laboratory chemical phenyl thiocarbamide but only to a somewhat lesser degree for sixteen other substances tested, including salt, sugar, quinine, cascara, picric acid, aspirin, saccharin, etc. Among the discrepancies noted were the following: for one individual saccharin was only thirty-two times as sweet as sugar; for another it was 2,000 times as sweet; for one subject quinine was

256 times as bitter as cascara and for another cascara was twice as bitter as quinine. One individual was found to be unable to distinguish between the taste of quinine and hydrochloric acid. A more concentrated solution of either tasted bitter and a more dilute solution of either tasted sour. Peculiarities of this sort are commonplace, but are not often noted partly because of our passion to learn about the average statistical man, who has no peculiarities.

Another substance which is known to yield different taste responses in different individuals is the relatively rare sugar mannose. To 15 per cent of the people tested it was tasteless, to 20 per cent it was sweet only, to 10 per cent it was bitter only, but to the majority, 55 per cent, it was both sweet and bitter in succession. To most of these it was sweet first and then bitter but to some the sensations were reversed.

If a person possesses acuteness of taste for one substance, this does not mean that his taste for other substances is also acute. The correlations though generally positive are relatively low. Fifteen subjects out of forty-seven in the study mentioned above were found to be classed as most acute tasters for one substance and as among the least acute tasters for one other.

Interesting, but unexplained, is the fact the taste thresholds of some individuals were found not to be stable but varied from time to time sometimes rather widely. It is well known that when one has a cold his ability to discriminate flavors is greatly diminished. The changes in taste thresholds were not always due to this, however, because they sometimes took place rapidly. Neither were they associated with any of the easily recognized rhythmic bodily changes which accompany eating, sleeping, etc. Some people's thresholds change very little; whenever changes do take place, there must be an accompanying change in the internal physiology of the individual which is responsible for it. So far we do not know what these changes are.

Psychological conditioning may also alter taste responses as in the often quoted example of the child for whom orange juice has the taste of castor oil, because the child habitually had castor oil ad-

ministered with orange juice. It may be worth noting that some children actually like castor oil and not a few like cod-liver oil.

A curious anomaly has been observed in connection with artichokes. For about 40 per cent of people, the eating of artichokes imparts no taste to water that is drunk afterward. For 60 per cent, however, the water has a marked and peculiar taste, sometimes characterized as sweet and sometimes as bitter. I know of one individual who has observed a similar though much more marked effect as a result of drinking milk immediately after eating artichokes. This resulted in a most unpleasant taste and an extreme aversion to artichokes (not milk) which lasted many months. I was advised not to try the experiment on myself because in case I was susceptible I would find it an extremely disagreeable experience.

When an exhibit was arranged at a scientific meeting several years ago and the people attending had an opportunity to find out for themselves their response to phenyl thiocarbamide, the reactions resulting from the fact that the substance was tasteless to some and very bitter to others were significant. People had difficulty believing each other. Many "non-tasters" insisted in effect that the substance was really tasteless in accordance with their own observation, and that the observation of "tasters" was a perversion. Others were equally certain that in reality it is a bitter substance. One man who found the substance tasteless tried to get his wife (to whom it was very bitter) to taste it again and again in order to convince her of her error. So far as is reported no one questioned anyone else's motives in the matter, but there was in effect, if not in actuality, name-calling.

5

It is not easy, nor is it profitable for our purposes, to attempt to draw a definite line between the sense of smell and the sense of taste, since they are closely related. Socially important differences with respect to sense of smell undoubtedly exist. There are an appreciable number of people who have virtually no sense of smell;

at the other extreme there are those who take great delight in flavors, perfumes and condiments and are highly discriminating with respect to this type of stimulus. Professional tasters undoubtedly start with relatively keen perception of certain flavors (otherwise they would never be attracted to this kind of work) and train their abilities till they are far beyond the expectations of laymen.

I remember hearing an expert in his field rave quite sincerely over the flavor of a sample of vinegar when to me it was plain vinegar and nothing more. Undoubtedly the ability to detect and discriminate between flavors is an important factor in the determination of one's attitude toward eating.

Even when there is olfactory acuteness, the experience of one individual does not necessarily agree with that of another. This was discovered most strikingly by Blakeslee and a fellow geneticist who were carrying out breeding experiments with verbenas. Among the other characters which were being watched in the offspring was the fragrance of the flowers, but curiously it developed that the two investigators did not agree at all. In fact they consistently disagreed. If one investigator rated a series of verbenas 1-2-3-4 on the basis of their fragrance, the other would rate them 4-3-2-1 in reverse order. The verbenas which were practically odorless to one turned out to be the most fragrant for the other, and vice versa. When the two verbenas, numbers 1 and 4 above, were submitted to forty people for judgment with respect to fragrance, ninety per cent noted fragrance in one or the other but not in both.[6]

Variability of response in individuals has been noted and studied in the case of a number of other flowers including nasturtiums and snapdragons, and also in connection with specific odoriferous principles. Vanillin and artificial musk yield highly variable responses with different individuals and cuminol and caprylic alcohol both have the characteristic of being very agreeable to some and highly disagreeable to others. We find in the chemical laboratory that while hydrocyanic acid, a highly poisonous gas, usually has an odor described as similar to bitter almonds, some students of chemistry are unable to smell it. A most striking idiosyncrasy of this sort is the

existence of a few individuals (I know specifically of three) who have a normal sense of smell in most respects but are not able to detect the odor of skunk. Even the pure substance n-butyl mercaptan, which the skunk carries for "perfume," has no marked odor to such an individual. Still another peculiarity has come to my attention—that of an individual for whom the skunk odor is distinctly pleasant. This later case is probably partly explained on the basis of the possession of a low sensitivity to skunk odor. It is common for substances with disagreeable odors—musk, indole, skatole—to be used in perfumery in high dilution. Strong odors are more often unpleasant but may be pleasant when diluted. The fact remains that skunk odor even when diluted is not agreeable to most people.

Though the heritability of olfactory responses in general has not been investigated there is a strong presumption, on the basis of known facts about taste differences, that such characteristics are inherited. Established facts with regard to inheritance of olfactory abilities in animals point in the same direction; some breeds of dogs, for example, have a keen sense of smell for game and others do not. Probably the genes which carry such traits induce the building up of specific enzymes or other mechanisms which make possible the registering of special odors by the olfactory system.

Just as some people are unusually sensitive to pleasant odors and flavors, some are unusually sensitive to unpleasant ones. If we could believe some of the advertising material which we hear, the way we smell (or rather do not smell) to our associates is one of the prime determinants in our social acceptance. For people who are insensitive toward perspiration odors, this seems particularly ridiculous. However, there are those who notice these odors much more than do the majority, and obviously the odors given off by different individuals are not the same.

Sometimes young children are highly sensitive to odors and have been reported to be able to detect and distinguish on a handkerchief or a piece of clothing the odor of its owner. Children are notoriously uninhibited with respect to their comments and sometimes describe

their olfactory impressions in simple terms. Not only may they dislike persons because of their odor, but often they have a dislike for perfume unless it is used very sparingly.

Probably the seeming intemperance of "fresh air fiends" is based partly upon high sensitivity to many odors and a desire to avoid stale odors which may be entirely unnoticeable to others. I remember clearly even after many years a neighbor's house which in the interior always had an extremely stale, composite, and unidentifiable odor which enveloped you the moment you stepped inside. The occupants were in most respects delightful people, but evidently husband, wife and children were not sensitive toward such odors. They may have been partially anosmic (without sense of smell). To ultra-sensitive individuals I suppose every dwelling has an appreciable odor which is somewhat characteristic.

Within recent years Russian investigators have claimed that the breath of elderly or ill persons contains substances that can be demonstrated to be toxic. It was relatively common for the old-time physician to notice odors and in some cases to claim the ability to diagnose certain diseases and recognize impending death by this means. People who are blind and deaf are reported to be able to use their sense of smell in the identification of others though this has been denied. To do this they would have to be endowed with a normal or supernormal olfactory apparatus greatly developed by noting and interpreting the stimuli.

To many of us odors go largely unnoticed unless they are especially obnoxious or pleasurable. People become accustomed to particular odors when they must live with them; for example, chemists are often unaware of the ordinary smells which exist in a chemical laboratory. The olfactory receptors like other sense receptors become refractory to the stimuli.

6

Though the concept of the five senses—sight, hearing, taste, smell and touch—has been traditionally accepted since Aristotle, physi-

ologists and psychologists fully recognize that man has many more senses than these. In the skin alone, according to evidence which is hardly controvertible, there are at least five senses: for (1) touch, (2) pain, (3) warmth, (4) cold, and (5) common chemicals such as acids, bases and salts. Extensive researches have demonstrated with a high degree of satisfaction that different nerves with specific types of endings are responsible for carrying these different types of sensations to the central nervous system. This does not mean, for example, that the specific nerves which carry the sensation of warmth are wholly incapable of carrying pain messages. The reverse is true, but there are nevertheless at least the five types of nerves which are especially acute and effective for their special purposes.[7]

The problem of how many senses are really involved in olfactory experience and gustatory experience is a very difficult one and is by no means solved. Smell and taste experiences shade into one another and a large number of sensations are elicited by various chemical substances. In addition to the tastes and smells which are commonly recognized there are such gustatory sensations such as the coolness elicited by peppermint and the hotness of chili peppers.

Individual differences in all these peripheral senses have not been extensively investigated but common knowledge and an acquaintance with our variabilities in anatomical make-up can leave no serious doubt as to their existence.

My attention was first attracted to these individual differences, and particularly the sense of touch, when I was about four years old. I was with my father in an orchard where ripe peaches were abundant, when he noted that although I liked the taste of peaches I could hardly be induced to touch one. The fuzzy skin made me cringe. My father was quite indifferent, himself, to this fuzz, but he told me that I had probably inherited my dislike from my paternal grandfather who had exactly my reaction to the skin of peaches. This peculiarity is not uncommon; probably it exists in different degrees, and is one basis for the de-fuzzing of peaches which are produced for commercial markets.

A case of a sensitivity of a similar kind has been called to my attention. A young man who is otherwise normal has a skin sensitiveness such that he cannot sleep comfortably in a bed in which an ordinary quilted pad is directly beneath the sheet. He must have at least two thicknesses between himself and the quilted pad. It is not unusual for people to differ markedly in their like or dislike for the feel of woolly blankets around their shoulders and neck.

It is said that one of the qualities that Chinese people enjoy about valuable jade, is its feel. They enjoy touching and stroking it with their finger tips and holding it in their hands; it would lose much of its charm if it could not be handled. It could easily be that the Chinese have as a part of their inheritance, along with specific types of facial features, etc., a sensitiveness to touch which is capable of unusual development.

A highly sensitive touch is probably inherent in a successful masseur, though it is doubtless improved by experience. His sense of touch tells him exactly how and where he should massage in order to give relief. Soreness and fatigue in muscles reflect themselves in changes in muscular tone and in other reactions which are readily detected so that the masseur's sense of touch tells him more accurately than the patient could the exact nature and extent of the soreness. The sensory apparatus of some individuals is such as to make it possible to develop skill in this direction. Others lack any such aptitude.

Ticklishness involves the cutaneous sense receptors and is another item on which there is great variability. It is well known that some individuals are practically devoid of ticklishness while others are extremely susceptible, and that different areas on the skin differ widely in this respect. One area may be susceptible in one individual and another in another. The nervous mechanism involved in tickling is not well understood but it seems to be a summated effect of impulses coming over pressure and pain fibers. Rubbing the skin, using appropriate pressure, will render it so that it cannot be tickled for a period of time thereafter, but the sense of pressure is unimpaired by this rubbing.

The extremely violent reaction which some people have against a dentist's manipulations is related to the cutaneous senses of pressure, heat and pain, and the existing differences between individuals are due partly to differences in the numbers, character and location of the nerve endings in relation to the tooth structures. Psychological conditioning may be important in such cases, though the acceptance of this idea is often based upon plausibility rather than upon evidence. No one cares to have a tooth drilled in close proximity to a nerve, but many people are relatively indifferent to ordinary grinding. My dentist tells me that one can never tell from appearances how a patient will respond, and cited a case of a husky sheriff who could hardly be induced to come near a dentist's chair except in extreme emergencies. He was, according to usual standards, a man of extraordinary bravery and in the conduct of his duties had been forced to kill several desperados. Yet so far as the dentist's chair was concerned he was a great coward. Presumably the nerve receptors in or around his teeth were such that this avenue of approach was like Achilles' heel.

7

Our fundamental metabolic and anatomical differences permeate all our senses, including those that are more obscure in their functioning. Not only are numerous gross bodily structures more or less distinctive for each of us—hands, feet, skeletal proportions, facial features, tooth structures, external ears, etc.—but the microscopic structures which are at the basis of senses are different as well. The rods and cones in the eye, the taste cells in the mouth, the hair cells in the ear, the various types of nerve receptors in the skin, the proprioceptors which are continuously sending messages notifying the central nervous system of our every move—all these nerve structures and many more may have in each of us distinctive anatomical characteristics.

Your index finger and mine do not have the same number of nerve fibers innervating them; the different types of receptors are

not present in the same numbers and are not of the same efficiency. Even the nerve fibers which are present may not function equally well—some may become refractory to a stimulus more readily than others; this means fewer impulses per second and hence less effective transmission. Different nerves do not carry messages at the same rate, and individual differences in this respect are to be expected.

Each of us might during the day be subjected to the same set of stimuli but because of the differences in each of our senses we cannot be affected in the same manner. Each of us through inheritance and training accepts certain stimuli predominantly and tends to ignore others; from the same set of stimuli each of us derives a different and distinctive pattern of sensations. How intricate and distinctive these patterns may be can be appreciated only by considering the large number of possible stimuli and the numerous types of sense receptors which we possess.

V. Other Physiological Traits

There's a great deal of unmapped country within us.

GEORGE ELIOT

NO RESOURCE OF SCIENCE should be neglected and no aspect of our natures can be overlooked, if we want to have a thorough knowledge of human beings, and until we apply science seriously to gain this knowledge we are basing our hopes for social control at least in part upon superficiality. Men are "wonderfully and fearfully made" and many elements enter into their physiological make-up in addition to those already mentioned.

The temperature of our skin, when the outside temperature is entirely comfortable, is about 90 degrees Fahrenheit—about eight degrees below that of the body interior. Under such conditions an object which is at 90 degrees feels neither cool nor warm to the skin. If an object with a higher temperature is applied to the skin, special nerve endings receive the stimulus and we get the sensation of warmth. If a cooler object touches the skin, other kinds of nerve endings are affected and the sensation of coolness results.

However, the temperature of the skin varies with individuals, and in any event does not remain at 90 degrees; it fluctuates much more than that of the body interior and there is a wide variation among people in the efficiency with which the skin temperature is maintained. For example, in an experiment a group of six normal young men exposed their hands in the same way to the same low temperature and then brought them back into comfortable surroundings

for ten minutes. The variation in the skin temperatures at the end of the ten minutes among the six was from 68 degrees Fahrenheit to 90 degrees Fahrenheit. In some individuals skin temperature comes back to normal rapidly after exposure to cold; in others it is very slow in returning. Different parts of the body respond differently; the extremities are particularly susceptible to wide variability, and some individuals are constantly plagued by cold feet or ankles.

Such striking differences in temperature adaptations, as well as differences in sensory responses, are partially responsible for the difficulties involved in maintaining public buildings, trains, etc., so that they are comfortable for everyone. Even during slight indispositions (colds) the temperature-regulating mechanism of the body may function imperfectly and one may be adversely affected by temperature conditions which would normally be satisfactory. If in the same surroundings our skin temperatures should go up and down in unison, then we might all feel drafts and coolness or too much warmth at the same time, but this is far from the case. One individual may find it difficult to sleep under the same bed covering as another; because of differences in speed of adaptation one may remain cold for a long period after retiring while the other under the same conditions may tend to swelter.

Since two *independent* senses are involved in registering cold and warm sensations a person may be highly sensitive to cold without being very sensitive to warmth. On the other hand one may be affected by rises in skin temperature and relatively indifferent to falling temperatures. These are factors which enter into so-called cold bloodedness and warm bloodedness, but to classify all people as belonging to one of these two groups makes the problem appear much simpler than it really is.

Sometimes people appear to be so sensitive to heat or to cold that they develop severe symptoms such as asthma, nausea and vomiting, or even collapse, as a result of being exposed to the condition to which they are susceptible. These responses are sometimes spoken

of as cold allergy or heat allergy, though supposedly allergies are not actually involved.

In connection with responses to cold, the so-called cold-presser test is worth noting. In this test the subject's blood pressure is taken on one arm, while the opposite hand is immersed in ice water for about a minute. As a result of this immersion nothing may happen; that is, the blood pressure may remain unaffected. However, there may be a sudden jump in the blood pressure which may amount to any value from zero to about 30 millimeters for individuals who otherwise appear normal. Individuals with high blood pressure almost always exhibit an even larger rise, and there is probably some connection between this phenomenon and a tendency toward hypertension. In any event it is significant that normal individuals differ so widely in their response.[1]

Included in the variability of responses to temperature is the fact that some individuals, because of innate physiological make-up or habits which have been developed, *notice* temperature changes more readily than others. For example, one person may sit in a drafty position until he is well chilled without ever thinking of his predicament. Another may notice immediately even slight deviations from a comfortable temperature. This may be related to the clinical observation that some people, although less sensitive to the subjective sensation of cold, may actually shiver visibly before they feel cold. On the other hand others may feel cold before there is any easily demonstrable change in skin color or texture.

The temperature-regulating mechanisms and temperature senses in some people are such that they never associate temperature changes with the development of a cold. I knew of a newspaper editor whose experience led him to be vehement on this subject. Not possessing the average susceptibilities and having learned that bacteria (or perhaps viruses) could cause a cold, he maintained with great heat that temperature had nothing whatever to do with colds. He apparently neglected individual differences and the possibility that the temperature of the skin and mucous membranes might affect the resistance to the invading cold-producing agents.

A veritable feud developed between himself and certain doctors—all probably based upon unrecognized physiological differences.

2

There exist many individual traits with respect to our digestive tracts and our internal organs. The digestive juices of different individuals, for example, are not the same. The saliva is the most easily studied digestive juice, and gastric juice may be collected for analysis without great difficulty. The pancreatic and intestinal juices on the other hand are extremely difficult to obtain from human subjects.

The two prominent ways in which saliva samples from normal people differ is in their starch-digesting powers and their acidities (hydrogen ion concentration, pH). The starch-digesting power differs greatly from individual to individual; it is not at all uncommon for a sample from one individual to have a starch-digesting power twenty or fifty times that of another. The significance of this difference is largely unknown. It has been reported that a high correlation exists between the content of the starch-digesting enzyme and the tendency for teeth to decay. Such a correlation has been denied, and it is certain that several factors are involved. The starch-digesting power of the saliva may be one element in the complex situation.

The hydrogen ion concentration of saliva differs in normal individuals from pH 6.2 to pH 7.6 and may correspond therefore to a slightly acid or to a slightly alkaline condition. The actual range of hydrogen ion concentration involved is about twenty-fold. Numerous attempts have been made to connect the salivary acidity with other conditions, particularly tooth decay, but without substantial success. Significant from the standpoint of our discussions is the finding of Rich, several years ago, of a relatively high correlation between the pH of the saliva and the aggressiveness and excitability of individuals. More excitable persons tended to possess a neutral or

alkaline saliva in contrast to the average which is on the acid side of neutrality. This subject needs more exhaustive study in the light of more modern psychological concepts than existed when Rich's investigation was conducted.[2]

Gastric juice, like saliva, is a mixed secretion and arises from more than one type of gland. As obtained from different individuals in a partially diluted condition after giving a standard test meal, its composition varies tremendously. The amount of free hydrochloric acid present in a given volume may commonly neutralize as little as 15 or as much as 75 units of alkali. As a matter of fact about 4 per cent of healthy children and up to 30 per cent of normal adults show the presence of no free hydrochloric acid at all in the gastric juice. In addition there are also those whose lack of hydrochloric acid is associated with a specific diseased condition. The amount of peptic enzyme present also varies widely from individual to individual. Relatively little is known about the composition of individual samples of pancreatic and intestinal juices—the most important digestive juices of all.

Wide variation in gastric and intestinal motility (spontaneous movement) are evident from X-ray and other studies. It is known, for example, that the rate with which healthy stomachs empty varies from person to person so that people may be classified as those with slow-emptying and rapid-emptying stomachs. Of course one group shades into the other. For two healthy individuals exactly the same amount of meat may require in one case only one hour and forty-five minutes to leave the stomach, and in the other three hours and forty-five minutes.

Just as the microscopic structural details and even macroscopic ones (visible to the naked eye) are distinctive for other parts of the body, so these details, including the nervous structures associated with the digestive tract, are different for each person. One of the most apparent differences in this connection is the variability in tendency toward constipation. For some, life is apparently a continual battle against this difficulty. Proper selection of foods containing a good supply of vitamins, minerals and roughage is valu-

able insurance against this difficulty but there always remain conditions which are due to anatomical and neurological differences, microscopic or otherwise, in the digestive tracts of individuals.

Though we are unconscious of it for the most part, our internal organs have their feelings in the sense that they continually are sending and receiving nerve messages. The messages they send are dependent in part upon the local stimuli which they receive, and all these organs are directed in minutest detail by the nerve centers that control their functioning. All of this happens involuntarily and is under the control of the so-called autonomic nervous system. We are more or less conscious of all the activities that are under our voluntary control but unless we are physiologists we never try to understand how the heart pumps, how or when the liver makes bile, when the digestive juices are being secreted or how, and when the kidneys do their remarkable job. All of these things and innumerable others are taking place constantly, utilizing intricate sets of mechanisms adapted exactly to the tasks to be done.

Since every nervous system has its individuality it should be expected that each autonomic system would also be distinctive. In any case the nerve messages that control the internal organs are subject to modification as a result of external stimuli and mental activity. This modification may take different turns for specific individuals. Emotional stress and anxiety are highly important as causes of stomach difficulties presumably because the messages to the numerous structures in the stomach are distorted and as a result the tissues poison themselves by improperly carrying out their job. But emotional states that may cause stomach trouble in one may cause heart, kidney or liver trouble in others. Because of differences in the microscopic anatomy of nervous connections or in the organs themselves the same external stimulus may, for different individuals, cause different pathological states.

Recognizable signals of distress or exhilaration do not come to us from our kidneys or livers and in fact one might pass through life without ever being directly aware of the existence of these organs within his body. This lack of awareness should not be taken

to mean that everything is going along in a perfectly uniform and humdrum fashion day after day. We assume that our livers are all about the same because we have very limited ways in which we can study the actions of the liver. If there were a number of ways of studying quantitatively the various actions of the liver, we would probably find that one person's liver differs from another person's liver just as much as two pairs of eyes differ. There are a multitude of biochemical transformations which the liver must perform and the numerous specific tasks which it must do vary from day to day depending on diet and other physiological factors. One liver may be above average in the efficiency with which it performs certain tasks and another excel in some other manner. Actually our livers or kidneys may become seriously diseased and may recover again all without our being aware of the situation or even of the existence of the organs.

3

The differences in individual hearts and in individual circulatory systems can readily be made apparent by specific measurements. During repose the average pulse rate for men is 70 beats per minute and about 80 for women. But among healthy adult individuals the rates may vary from 50 to 90. Average blood pressures for young adults are about 116 mm. systolic and 70 diastolic, but there is considerable variation even between normal healthy persons. In fact no one can be sure just where normal leaves off and abnormal begins.

Mere pulse rates and blood pressures alone give a highly superficial conception of the measurable characteristics of the system. Among the other measurements that can be made are such as the following: variation of blood pressures with external conditions, velocity of blood flow in different regions, blood pressures in veins and capillaries, difference between central and peripheral pulses. Many of the phenomena connected with the circulation cannot be studied without obtaining a continuous record of changes in blood pressure during a time interval or recording the electrical impulses

which accompany the heart beat. In all these measurements we find significant differences between individuals.

Sphygmograms, which are records in the form of continuous wavy lines of the variation in blood pressure from instant to instant, have certain general features in common for all individuals. However, if the amplitude, frequency and exact shape of the waves is considered, each individual produces a distinctive record which tells something as to the precise timing and intensity of the various actions of the heart. This record will vary with the location in which the blood pressure is recorded, and this variation may throw light on peculiarities which exist in the intermediate blood vessels.

Intimate pictures of the functioning of the heart may be obtained in electrocardiograms which register in amplified form the tiny electrical potential changes that accompany heart action. These may be obtained in different manners by connecting the two electrodes in different respective positions. For each individual the wavy record of the potential changes has its own peculiarities.

4

The study of breathing patterns has revealed some interesting facts with respect to the rate of breathing, depth of breathing, the presence of a pause at the end of expirations, sighs (breaths about twice as deep as ordinary), swallowings, etc. All of these features and others enter to make the pattern of an individual distinctive as illustrated by examples of spirograms on page 89. These are simply record tracings of inspirations and expirations of breath. The two spirograms at the top of the page are of the same individual. They show a marked similarity of pattern even though the tracings were made with an interval of two years in between. The four other spirograms are of other individuals. In all cases the subjects were free from any obvious cardiac or pulmonary insufficiency.[3]

While there is a hope that breathing patterns may ultimately be correlated with othei physiological or psychological traits, they are

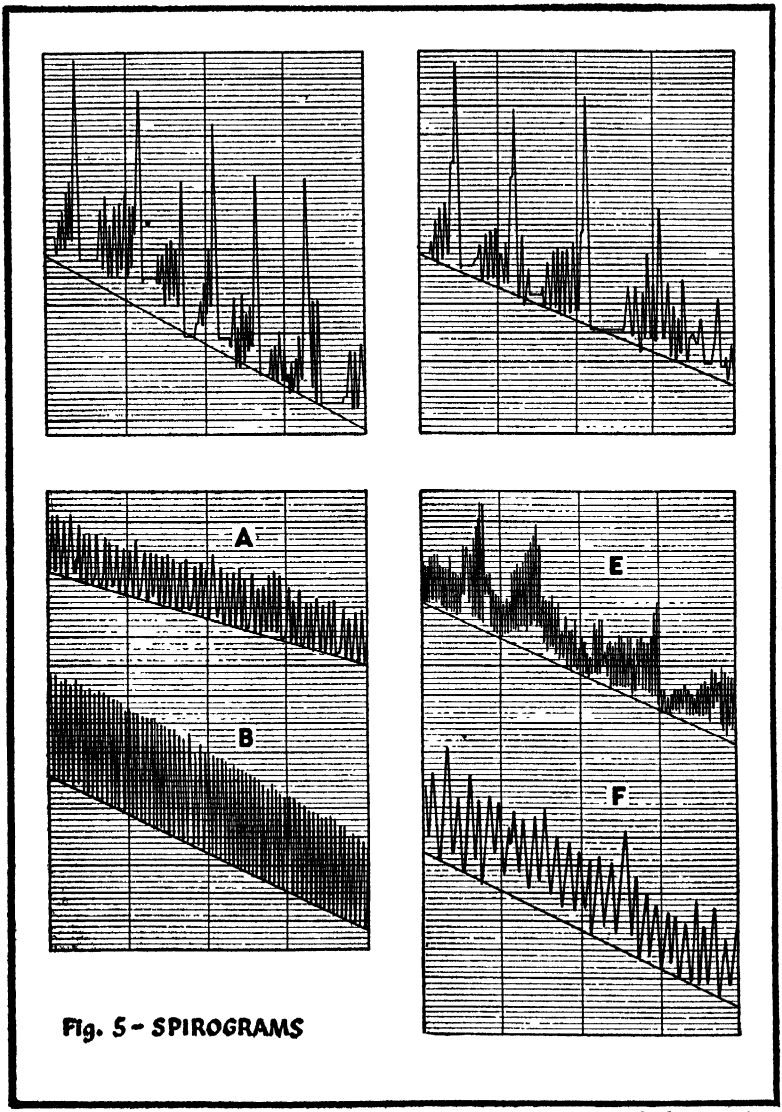


Fig. 5 – SPIROGRAMS

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These tracings show in graphic fashion how different individuals inhale and exhale at different speeds, to different depths, and according to different patterns. The upper two are from the same individual; the lower four are from four individuals, "A," "B," "E," and "F."

certainly not readily interpretable in the light of present knowledge. Frequent sighs and other irregularities are said to be signs of instability; on the other hand, certain types of regular tracings are reported to be common among schizophrenics and schizoid individuals. These and other features doubtless have meanings which might be adequately interpreted if we had a more intimate picture of the whole bodily mechanism of the individual. This is the type of clue that will not be overlooked or followed up half-heartedly in a scientific and thorough study of human beings. Tracings of breathing records are easy to take and their analysis may lead ultimately to important insights.

5

Though scientific data are not available to support the statement, I believe it is obvious to the reader that individual persons differ greatly in their tendency toward general fatigue. We may speak of a man of extraordinary energy as a human dynamo or say that he is a horse for work. Theodore Roosevelt was an ardent exponent of the strenuous life and this could not have been if he had not been endowed with great energy.

Genius has sometimes been defined as a capacity for hard work. Edison said, "Genius is 1 per cent inspiration and 99 per cent perspiration." Whether or not these statements are correct, this capacity is certainly an important factor in greatness. I was much impressed with this fact on a recent occasion when I saw an eighty-year-old man of high attainments carry through a program in twenty-four hours that might well have staggered a man of half his age. He entertained guests for dinner and with conversation that lasted until late into the evening; he gave an excellent impromptu address the next day at a luncheon (incidentally with absolutely no reminiscing), excused himself to preside over an important board meeting, and later in the afternoon gave a serious prepared address to many thousands of people. The fatigability of such a person is in sharp contrast to that of the more typical man. This is the basis for

the fact that a well-known comic-strip character has endeared himself to many thousands of people because of his weakness for taking naps.

Fatigability in the general sense is probably complex and involves psychological and neurological factors to a large degree. Eyesight may be important in this connection, though good eyes in the ordinary sense are not necessarily the possession of a man with great energy—Theodore Roosevelt's eyes were very poor by ordinary standards. Nearsighted eyes are not characteristically subject to fatigue and often can be used extensively. From our previous discussion it is clear that there are many factors that enter into the use of the eyes. Fatigability is probably an important though not a simple character which varies greatly from individual to individual not only with respect to eyesight but with respect to each of the functions that we are capable of performing.

While there appear to be no collected scientific data to substantiate the idea, there seems to be a wide variation in people's requirement for physical exercise. President Hutchins of the University of Chicago is reported to have said that when he has the urge to take physical exercise, he lies down and relaxes to let the urge wear off. If this expedient is satisfactory in his case, he is vastly different from some individuals for whom regular exercise is an essential prerequisite for peace of mind, mental vigor and normal sleep.

Related to physical activity and fatigability is the phenomenon of sleep, and the fact that individuals apparently differ both in their total daily requirements and in whether or not their daily quotas are best taken all at one time. While adult man is usually classed as monophasic in his sleep habits as opposed to rats and rabbits which are polyphasic (that is, sleeping several times during twenty-four hours), there is a marked tendency toward individual difference in this respect. Edison and Napoleon are famous examples of men who slept comparatively few hours at night but tended to make up for it by naps in the daytime. Successful writers and artists, who can be independent with respect to when they work, often keep hours

which may be regarded as outlandish by those with customary working hours.

Earlier physiological studies on sleep indicated that individuals may be placed in one of two groups: first, those whose sleep is most sound within an hour after going to sleep and who are most wide awake and mentally alert soon after waking; and second, those who go into a sound sleep more slowly, that is, in from an hour and three quarters to three and one half hours, and who are most efficient later in the day several hours after they awake.[4] Other investigations have indicated that individuals differ with respect to whether they sleep more soundly (that is, with less moving around) in the fore part, the middle part or the later part of the night.

In the extensive study of the physiology of sleep comparatively little attention has been paid to individual cases. However, Kleitman found an unmistakable and significant difference between himself and one of his co-workers in an interesting study conducted in part in Mammoth Cave, Kentucky, where the experimenters lived away from all contact with day and night and the ordinary twenty-four-hour rhythm.[5]

It is well known that the body temperature of individuals goes down at night, reaching a minimum in early morning and then rising to a maximum in the afternoon. When the two investigators adopted an artificial cycle of twenty-eight hours instead of the natural twenty-four-hour cycle, and turned out the lights for sleep nine hours out of each twenty-eight hours, one of them shifted his schedule without difficulty within a week and the record of his body temperature showed that it went down each artificial night and completed six cycles during the six artificial days of twenty-eight hours each. (The six artificial days of twenty-eight hours made 168 hours, the same as a normal seven-day week of twenty-four hours each.) The other investigator, however, reacted very differently. He could sleep well when his sleeping hours corresponded with his natural sleeping time (on the basis of the natural twenty-four-hour day) but otherwise had difficulty. Most striking was the fact that his temperature fluctuations did not adjust themselves to the artificial

twenty-eight-hour day but instead remained on the twenty-four-hour schedule and completed seven cycles in the artificial six-day week. Part of the time his minimum body temperature came in the middle of the artificial day and it was at these times that he had great difficulty in remaining awake and holding to the artificial schedule.

This is not an isolated example for it is found that round-the-world travelers who must adjust their schedules, and radio operators in the navy whose schedule involves a broken rhythm, belong in one of two general classes—those who adjust readily and those who have difficulty in living on a schedule not involving a twenty-four-hour rhythm.

In view of the large number of people in the world whose sleep cannot come in the usual hours, these facts are of social importance. Furthermore, they demonstrate beyond question that individuals differ in their responses to sleep, and that no rule is likely to apply to all individuals.

Unfortunately, few facts regarding the sleep requirements of individuals have been established. If individual A sleeps relatively long hours, and individual B carries on with much less sleep, it cannot be concluded that each is getting what he needs. A may be getting more sleep than his efficiency and good health demand, and B might be better off with more.

Such a problem as sleep requirements is by no means beyond the powers of science to solve, and additional information should be obtainable without extreme difficulty. It should be possible to differentiate between a person who is well rested and one who could profit by additional sleep. Some investigations have shown for example that a short sleep is as effective as a longer one in conditioning an individual for simple arithmetical tasks, but not for more complicated ones. As soon as we can distinguish definitely between a well-slept individual and one who is not, it will be possible to study the problem of sleep requirements and to see whether they vary greatly for individuals and whether the requirements are correlated with fatigability, with the possession of energy, or with other significant traits.

Among the measurable changes which accompany sleep are the following: the rate of metabolism decreases, the frequency of the respiratory movements decreases and their character changes, the pulse rate and the blood pressure decrease, and significant changes in the circulation take place which involve an increased blood supply and an increase in the volume of the hands and feet. By the use of a plethysmograph, which measures changes in volume, for example those of the hand and forearm, it is shown that immediately upon going to sleep the volume of an individual's hand increases because of a fuller blood supply, and remains high as long as sleep continues. However, if there is a noise which is almost but not quite enough to wake the sleeper, the volume of the hand immediately decreases so that it is nearly normal. On a resumption of deep sleep the hand volume again rises. During the course of a night's sleep an individual's hand may fluctuate in volume many times depending upon the extent to which his sleep is disturbed. Less easy to measure is decreased secretion and a consequent dryness of the surface of the eyes. This condition, which is responsible for the idea of the "sandman," accompanies sleepiness and is abolished by sleep. One of the most potent means for the study of sleep is furnished by the brain waves (tiny electrical impulses generated by the brain) which progressively modify their character during sleep. Post-sleep brain waves, and brain waves obtained after awakening from a dream, are distinguishable from pre-sleep records and this type of study is capable of almost unlimited extension.

With all these and other physiological manifestations as a basis it seems reasonable that variability in the sleep requirements of individuals can be studied with exactness and that industrial and everyday life can be adjusted somewhat to meet the physiological needs of different types.

Attempts to ascertain precisely why we need sleep and exactly what sleep does for us have so far been unsuccessful. When we have explored more deeply we shall probably find reasonably satisfying answers which will enable us to make more efficient use of our

waking and sleeping hours. We will not arrive at satisfactory results as long as we assume that what applies to one individual applies to all and neglect the fact that for each of us the nervous system functions differently with respect to waking and sleeping rhythms. There are a number of sleep eccentricities which emphasize the importance of considering and appreciating individual differences. Among these is narcolepsy, which afflicts otherwise normal individuals and involves repeated sudden short-lasting attacks of sleep which may vary in severity and duration, and several types of insomnia, involving (1) delayed onset of sleep, (2) wakefulness in the middle of the night and (3) early awakening with accompanying inability to go back to sleep.

6

Talkativeness or the "gift of gab" is a trait that is very unevenly distributed among people. I have classified it as a physiological trait principally to emphasize that talking is a process which involves muscular and nervous co-ordinations the complexity of which would be difficult to exaggerate. When a Walter Winchell, a Walter Judd, or a skillful announcer at a football game puts on an exhibition, it is a remarkable phenomenon regardless of whether we are interested in the subject discussed or depicted.

Throughout history there have been fluent talkers; also those who have been relatively speechless, and all gradations between. According to the biblical account, Moses was severely handicapped by his slow tongue. Even after his experiences in a series of miracles—changing a stick into a snake and back again and making his hand leprous and curing it—he still protested that he could not serve as the Lord's representative, because he was "slow of speech and of a slow tongue" and the people wouldn't listen to him. Fortunately Moses had a brother Aaron who was a smooth talker and willing to take instructions. When he was told what to say he functioned brilliantly as official spokesman. Transforming the slow-tongued

Moses into a man who could himself talk fluently is a miracle that is not recorded.

A person who has difficulty expressing himself verbally may be gifted at literary expression, and the reverse may likewise be true, but the possession of one ability may have no relation to the possession of the other. In some individuals both may be present, in others neither. Talking involves intricate and rapid muscular and nervous co-ordination and the differences between individuals is doubtless based upon anatomical differences in the organs of speech and particularly in the whole nervous apparatus that controls the intricate movements involved. Probably numerous factors such as auditory sensitivity and memory enter into the speech behavior of individuals. The fact that one is quiet rather than talkative does not mean that he or she possesses an unattractive voice; the reverse may be true. Neither can we be sure that the quiet person is in the habit of thinking deep thoughts. We can be sure in the case of some talkative people that they do not!

The ability to express oneself verbally is of great importance in all walks of life. To be able to vocalize one's thoughts quickly and clearly is probably an important factor in gaining dominance and leadership, both because of its effect on listeners and because of the self-confidence it engenders in the speaker. While speaking fluently can doubtless be cultivated by study and application, it goes without saying that individuals differ greatly in their native abilities in this field. It simplifies the matter too greatly if we try to classify everybody as belonging to a group of good speakers or poor speakers. A person under one set of circumstances may be highly effective, whereas with another set of listeners he may fail. A man who has great natural endowment, in that the appropriate words come to him rapidly and easily, may through falling in love with the sound of his own voice become ineffective because of his long-windedness.

The variances in thought-speech co-ordination and thought-writing co-ordination are marked. Some people have difficulty in getting their thoughts on paper simply because their hands cannot work fast enough to keep up with the words which come to them.

These can dictate material readily. One of the most extreme cases of this type was the Spanish author, Manuel Fernández y Gonzales (1821-1888), who dictated not to one secretary but to several, working on several books at the same time; in this way he produced some three hundred novels. Many writers, on the other hand, are wholly unable to dictate with effectiveness.

It is a common observation that women are on the average more talkative than men. This of course does not mean that all men are quiet and all women talkative. A wide variation exists in both groups so that some men are far more talkative than some women.

No one, so far as I know, has invented a talk-meter which will register the number of words spoken, in the way that a pedometer registers the number of steps taken by an individual. A talkative person could under most favorable circumstances have an output of 50,000 or more words a day, while a quiet person might not use more than a few hundred in the same interval. Whether one is talkative or quiet is a matter of considerable social concern and probably has far-reaching effects on the development of one's personality and influence.

7

Many little acts of everyday life reflect the fundamental differences in our muscle-nerve co-ordinations. It is not polite to watch or appear to watch a dinner companion eat, but one does not have to look long to see that people in hotels and restaurants often eat distinctively. Some load the food onto the fork with rhythmic scooping motion; others load it gingerly as if the peas were delicate pearls; others give the fork a business-like thrust. Once the food is brought to the mouth some eaters fairly snap it off the fork as though it were mobile and alive, while others carefully comb it off the fork with the lips. The rapidity, violence and character of the chewing motions introduce new variables. Such minor differences do not appear to be worthy of extensive study but it is worth noting that they have the same type of physiological basis as handwriting does

and are distinctive for the same reason. Walking is another everyday activity that each of us performs in a characteristic fashion, and it is often easy to recognize an acquaintance at some distance by observing his gait.

The almost unbelievable way in which minute patterns of activity reveal their individuality is shown by the fact that each radio operator has his fist, or manner of tapping out messages, which is distinctive and recognizable by those who are practiced in receiving messages. The United States Radio Intelligence Division made use of this fact in connection with an illegal station in Chile operated by "Pedro," a young German. When the Chileans closed in on the station, Pedro escaped. A year later experienced listeners spotted a new illegal transmitter and were able to recognize Pedro as the operator. In order to disguise his fist, he was sending the messages left-handed but the disguise was not effective and he was apprehended.

Another example of individuality in connection with muscle-nerve co-ordination is observed in connection with tremor. If one holds up a finger unsupported, there is a certain degree of tremor, regardless of how well or normal the individual is. Such tremors in normal individuals rarely exceed .3 mm (about .01 inch) in amplitude, and take place at the rate of six to twenty-one complete oscillations per second. Among the interesting facts regarding finger tremors is that they are distinctive for each individual. This is due presumably to the difference in the volleys of efferent impulses and their effects on the muscles. That they may be associated with muscular tension is evidenced by the fact that the tremor is greatly increased if one tenses his muscles and attempts to hold the finger rigid.

In one series of tests involving five individuals the effect of various factors on finger tremor was studied: (1) squeezing a dynamometer with the opposite hand, (2) doing a mental arithmetic problem, (3) taking a reaction time test, (4) being startled by a loud noise. In each case the finger tremor of the five subjects was increased but each responded in a different manner. Subject R, for

example, was the one most affected of all, by tests 1, 2 and 4, but was the least affected of all by 3. Subject T, on the other hand, was second among the five in his response to tests 1, 2 and 3 but was far below all the others in his response to the loud noise.[6]

Aside from possible correlations with personality differences, the most useful significance of finger tremors lies perhaps in the fact that they seem to have a direct relationship to fatigue. Four individuals had their finger tremors tested before and after performing three successive amounts of work, each involving 500 foot-pounds. The results showed that (1) the rate of tremor, (2) the average amplitude of the tremor, and (3) the irregularity of the tremor, all increased successively with increasing fatigue. It seems that finger tremor might be a useful tool in studying tension, fatigue and sleep requirements of individuals.

Suggestive of the possible usefulness of finger tremor studies is the report that neurotic children show larger responses than normal. Finger tremors are not only distinctive, they are independent of brain waves, galvanic skin responses and blood pressure changes.

8

Another physiological response in which there are wide differences between individuals is that of detection of subliminal stimuli (those too weak to arouse sensation). It is found in connection with visual stimuli, for example, that if a person is confronted in the dark with one of three geometrical figures—a circle, a triangle or a square—he may be able to "guess" with some validity which it is, even though the light is so limited that he is not able consciously to see the figure at all. Actually, such an individual must be receiving visual impressions but they are below the limits of conscious vision.

Four subjects (the total number studied) when confronted with these three figures in the manner indicated, guessed right as follows:

Subjects	*Total Presentations*	*Correct Replies*	*Number of Correct Guesses Based on Chance*
F	213	106	71
W	210	118	70
Mi	183	83	61
Ma	201	90	67

Every one of the subjects yielded correct answers more often than could be attributed to chance, even though they could not consciously see. Subject W, however, gave the correct answers 56 per cent of the time, 23 per cent above what could have been done by chance, whereas subjects Mi and Ma were correct only about 12 per cent above the 33 per cent which chance alone could explain.[7]

In a similar test involving reception of subliminal auditory stimuli, ten subjects were tested for their ability to "guess" with respect to the pitch of a sound which they could not consciously hear. Of the ten, three gave responses significantly better than chance could explain; five others responded slightly better than chance but not enough better to be significant statistically. The "guesses" of two were apparently pure guesses for their correctness was even slightly below what chance alone could explain.[8]

The importance of these phenomena, so far as our purposes are concerned, lies principally in the fact that they demonstrate wide variation between individuals. They are interesting in themselves, however, and the possession of these abilities may be used to explain adequately certain common phenomena which are otherwise puzzling. For example, if you are seated in a chair and some one takes a position behind you, you may be able to "sense" their presence even though they made no *audible* sound nor cast any *visible* shadow which could give you a clue. Inaudible sounds, such as those of quiet breathing and shadows so slight as to be invisible, may be responsible in such a case.

Every nervous impulse and muscular action in the body is accompanied by the production of minute amounts of electricity. By amplifying these and excluding extraneous sources of electricity it becomes possible to measure the electrical potentials which arise

from different parts of the body. The record of the electrical output of the heart is used extensively in diagnosing heart conditions and is known as an electro-cardiogram. Similarly if electrodes are placed upon the scalp the electrical potentials arising in the brain can be recorded in the form of an electro-encephalogram.

Electro-encephalography is used extensively in medicine in the diagnosis and localization of brain tumors (which are inactive electrically), in the diagnosis and study of epilepsy, head injury, and sleeping sickness. The application of the electro-encephalograph to malingerers or those who are faking blindness or faking amnesia is said to reveal normal patterns and thus make possible the recognition of the true condition.

But for our purposes the relation of these brain waves to so-called normal people is more interesting. There are many ways in which brain potential records may be obtained and they possess a number of revealing qualities. One of the commoner aspects which is often studied is the appearance and disappearance of the alpha waves. These waves occur from eight to twelve times a second, involve a voltage of from 20 to 75 microvolts, and occur in normal individuals when they are resting with their eyes closed. Among fifty normal individuals tested, nine showed alpha waves less than 25 per cent of the time, thirteen showed these waves 25 to 50 per cent of the time, sixteen showed them 50 to 75 per cent of the time, and twelve showed them 75 to 100 per cent of the time. People therefore can be classified on the basis of the prevalence of alpha waves in their brain potentials. In addition there are beta waves which involve less voltage but are more rapid, eighteen to fifty waves per second, and slow delta waves of relatively high voltage, which are characteristic of sound sleep. Altogether, brain-wave patterns are highly complicated and are capable of extensive study. Presumably all the observed waves could be studied more intensively, if desired, and by further magnification additional features would become recognized.

Because of their complexity it is not surprising that each individual has a distinctive pattern. They vary in the frequency and

voltage of the alpha, beta and delta rhythms, and in regional differences with respect to each of these, and other features. It has been demonstrated that an individual can be identified by his brain-wave pattern and that these patterns are highly consistent for a given individual provided the conditions are the same—subject awake with eyes closed and mind kept as blank as possible.[9] Identical twins have brain potentials which are very similar if not identical, indicating that these patterns are inherited. The failure of such twins' brain potential patterns to be completely identical is probably due to partial asymmetry reversals, which are discussed in a later chapter on heredity and environment.[10]

Partly because of the complexity of the wave patterns and the complexity of personalities and thought processes, little progress has been made in correlating the two types of phenomena. One investigator has said that the majority of normal individuals exhibiting a high degree of extroversion will show a dominant-subdominant alpha rhythm. Other investigators have questioned this finding. Others have found that dynamic personalities are likely to exhibit rapid brain waves and dependent personalities slow ones. Those exhibiting alpha waves a high percentage of the time are said to be subject to asthma and ulcers. Delinquent children and those with poor personalities are reported to yield slow waves.

Much further investigation is required, however, before brain waves can be adequately interpreted in terms of personality traits. One of the great difficulties involved is the fact that experts in dealing with brain waves are rarely experts in the analysis of personality traits. Analysis of psychological traits is very difficult, as will be shown in a later chapter.

VI. Endocrine Glands and Behavior

In him inexplicably mixed, appeared
Much to be loved and hated, sought and feared.
LORD BYRON

Of all the tissues of the body, no type is more interesting or important from the standpoint of the functioning of the whole individual than the endocrine glands. Certainly a thorough and scientific study of human beings, which we have regarded as an essential foundation on which to build social control, cannot neglect these glands.

The general mode of operation of the various well-recognized endocrine glands is essentially the same. These glands produce and give off into the blood specific chemicals which are carried throughout the body by the circulatory system. The active chemicals (hormones) may produce effects in parts of the body remote from their points of origin (the endocrine glands).

Insulin is an example of a hormone. It is produced in the pancreas gland and is released slowly into the blood. The effects are much the same as if insulin were injected slowly, at appropriate times, with a hypodermic needle. Insulin travels in the blood to various tissues where it performs its specific function which makes possible the combustion or burning of carbohydrate. In many other instances an extract prepared from a particular gland tissue can be injected into the blood artificially and will produce a result similar to that brought about by the gland from which the extract was derived.

The crux of the problem of the functioning of the endocrine

glands lies in the hormones which are produced, and the determination of the chemical natures of these agents constitutes one of the larger and more pressing problems of biochemistry. Until a hormone is known chemically, or at least until it is available in uncontaminated form, its actions cannot be studied with definiteness or valid conclusions drawn about its functions or the exact functions of its parent gland.

The field of hormones has been a fertile one for speculating and theorizing and it would require many volumes to set forth all the ideas that have been proposed to explain the various phenomena associated with hormones and endocrine glands. Even if we restrict ourselves to well-authenticated information we find the material very extensive.

Much of the theorizing about the endocrine glands has been based upon very incomplete knowledge about the hormones that are supposed to be involved. When crude extracts of glands are injected (for example, into experimental animals) there are three types of uncertainty which arise: first, whether the active hormone has actually been preserved (or destroyed or lost) in the process of making the extract; second, the possible presence in the extract of extraneous proteins or other materials which may complicate the effects; and third, the possibility that extracts prepared in approximately the same way may carry two or more hormones in varying amounts, each capable of acting more or less independently to accomplish a different result.

There are at least a dozen glands in the body which produce and release hormones. There is reasonably good evidence for the existence of about forty different hormones; this means on an average about three hormones to the gland. Actually, however, there are several glands that produce only one hormone each and others that produce as many as six or eight or more. The thyroid and the pancreas apparently produce only one well-recognized hormone each, thyroid hormone and insulin, whereas the pituitary gland produces almost certainly as many as six and more likely eight or ten.

There are, in general, two ways in which an endocrine gland may

be stimulated to activity, that is, to produce and release its hormones. It may act because of nerve impulses coming to it through the autonomic nervous system (impulses of which we are unconscious), or it may become active through the effect of another hormone produced in some other gland and brought to it by the blood. Hormones from other glands, however, may work in the opposite direction—that is, they may hold in check and inhibit rather than promote the activity of a gland.

Anyone who attempts to explain human or animal behavior simply in terms of hormones is barking up the wrong tree in so far as finding a simple explanation is concerned. The glands do not work automatically—they are often under nervous and hormonal control and are affected by such external factors as light, nutrition, etc. Furthermore we cannot be at all sure that the body's susceptibilities to different hormones will remain constant from hour to hour or day to day. There is evidence in some cases that the body may produce anti-hormones which tend to nullify the effects of specific hormones. In many cases the activity and effects of a particular gland are modified by two or three other glands located in different parts of the body. These others may be subject to nervous control or to control by other glands. A more intricate set of relationships would be hard to imagine.

Because of these complexities it will be possible for us to consider only a few of the more interesting and less technical aspects of the subject.

2

One of the best known of the endocrine glands is the thyroid which releases into the blood a single hormone—one which has a profound effect on the metabolism of the various cells of the body. Some investigators are of the opinion that in certain diseased conditions, commonly called exophthalmic goiter, the thyroid gives off a modified hormone, not the normal one, and that this is respon-

sible for at least part of the difficulty. This possibility should not be overlooked in connection with the endocrine glands in general.

Severe lack of thyroid secretion may have far-reaching effects on the body; if it occurs early enough in life the child may develop into a dwarfed idiot. More mild deficiency may lead to feeble-mindedness. These mental changes occur not because we think with our thyroids but rather because of the indirect effect—the thyroids have to do with regulating the metabolism in all the cells of the body. Obviously the nervous tissues may be profoundly affected.

How much thyroid hormone is released in an adult may determine whether he or she is sluggish and apathetic or at the other extreme, fidgety and excitable. In addition to various bodily changes, deficiency in some cases may cause extreme depression. Delusions and hallucinations of hearing, sight, smell and taste may occur. It has even been reported that the type of insanity known as dementia praecox may be precipitated as a result of thyroid deficiency and rare reports of complete cure of this malady by administration of thyroid hormone are in the medical literature.[1]

Even with this gland, which is probably the best understood, we are yet in the dark as to the exact nature of the hormone secreted into the blood. We know that it has in its make-up thyroxin, a completely identified chemical, and that feeding thyroxin has substantially the same effect as feeding thyroid tissue. We do not know precisely how the thyroid hormone does its work. Feeding thyroid tissue to an animal speeds up its metabolism, but treatment of tissues and cells directly with thyroid material has no comparable effect.

3

Certainly the most interesting endocrine gland is the pituitary (hypophysis). It is one of the smallest of the glands—about the size of a large green pea—but is extremely productive of hormones, most of which are still unknown chemically. Several of the hor-

mones are protein in nature and are too complex to be duplicated in the chemical laboratory by synthesis.

One of the most interesting characteristics of the pituitary is its production of a growth hormone a deficiency of which leads to dwarfism and a superabundance of which causes gigantism. Giants in general, who in rare cases may be over nine feet tall and reasonably well-proportioned, have had their growth stimulated by an overactive pituitary gland and many intelligent midgets may ascribe their failure to grow to a pituitary deficiency.

Possibly even more interesting is the action of the pituitary in producing hormones that affect the activity of other glands. The thyroid gland, important as it is, is dependent upon the pituitary gland for a stimulus to its activity, and it is not infrequent that a thyroid deficiency may be traced, not to a difficulty in the thyroid gland itself, but rather to a failure of the pituitary to produce the thyroid-controlling (thyreotropic) hormone. The relationship is not entirely one-way, however; removal of the thyroid glands from an experimental animal causes marked changes in the microscopic appearance of the cells in the pituitary, showing that the pituitary is in turn influenced by thyroid deficiency.

The pituitary gland also affects various other glands just as much as it does the thyroid. Its secretion makes an animal much less sensitive to insulin, the internal secretion of the pancreas; it yields a hormone which stimulates the adrenal cortex to activity and likewise produces hormones which in turn affect hormone production by the sex glands. One of the most striking effects of injecting pituitary extracts into experimental animals has involved the development of precocious sex behavior in male baby chicks. Injection of pituitary hormone preparations into such chicks has caused them to crow with canary-like squeaks nine days out of the shell, and to attempt mating behavior before they have lost their down. Such extracts cause premature development of the sex glands and promote the production by the sex glands of the characteristic sex hormones.[2]

Not only do the pituitary hormones affect other endocrine (duct-

less) glands, but in one case at least a pituitary hormone stimulates a gland which secretes through a duct—namely, the mammary or milk-secreting gland. Prolactin is a name which has been given to this hormone. It is protein in nature and is one of the few protein hormones that has been obtained in purified condition. Repeated injection of a virgin goat with material containing this hormone has caused a secretion of up to 5.8 pounds of milk a day and a similar procedure has caused the secretion of 15.5 pounds of milk a day by a virgin heifer.[3]

Even more interesting is the effect of this hormone on the psychology of experimental animals. Young unbred female rats are normally not interested in baby rats and will ignore them when they are put into the cage. However, if such young rats are injected with prolactin preparations they immediately take interest in the young—not only do their mammary glands swell and produce milk but they become big-hearted as well and will build nests for and attempt to mother as many young as are furnished, regardless of race, color or previous condition of servitude. In fact the yearning is so strong that such rats will not only accept baby rats but also baby mice or baby rabbits or even baby pigeons—squabs. Lacking anything else to mother, such an injected rat has been known repeatedly to pick up her tail in her mouth tenderly as though it were a baby rat and carry it ceremoniously to the nest that she has prepared. Fallacious as it may appear to attempt to explain behavior simply in terms of hormones, it would seem nevertheless ridiculous to try to understand behavior and personality without taking account of hormones.[1]

4

Among the hormones that are known to affect behavior in a striking manner are the sex hormones.

If there were simply two kinds of sex glands (testes and ovaries) and two kinds of sex hormones, one male and one female, the situation would be vastly simpler than it is. Actually there are

several male hormones and several female hormones. Furthermore, hormones having to do with sex arise in several locations, not only in the sex glands themselves.

We have already noted a marked indirect effect on sex activity which pituitary hormones may have. The cortex of the adrenal glands likewise may have a profound effect on sex. If the adrenal glands are removed from an experimental animal, loss of sex drive is notable and the cells in the testes of males tend to degenerate. In females estrus ceases as a result of adrenal removal; if they are pregnant, abortion results; if they have young when the adrenals are removed they cease to give milk. Whether the effects of the adrenal glands are all indirect is not fully known because some of the hormones obtained from adrenal glands actually have sex hormone activity of themselves. Overactivity of the adrenal cortex may result in sex precocity in males or in the masculinization of a female so that she becomes a pseudohermaphrodite, with female sex glands but with many male characteristics. Apparently overactive adrenal glands, presumably through overdevelopment of a different kind of cells, may also have a feminizing effect on a male. One example cited is that of a forty-four-year-old man with a normal sex life who was married and had two sons. A tumor developed in his adrenal glands which resulted in his feminization. His breasts underwent development; his sex organs decreased in size; his sex desire and potency disappeared and he tended to lose his body hair. Successful removal of the tumor caused him to lose the feminine characteristics and made him a normal male again.

Because of these complex interrelationships the phenomena of sex are far from simple. With a series of glands harnessed together and capable of profoundly influencing one another, a particular result may be caused in several different ways. The sex life of females is even more complex than males because of the sexual cycle, pregnancy, childbearing and lactation.

5

One of the most far-reaching and important facts upon which all competent students of the physiology of sex agree is that human beings are actually, and to a larger degree potentially, bisexual.[4] The composite of masculine and feminine characters which we all possess has sometimes been called the "mosaic of androgeny"—from the Greek meaning male-female.

During the embryonic development of the sex glands of a human individual, these glands as first formed are equally male and female. The outer portion (cortex) is female in nature while the central portion (medulla) is male. In the development of the female ovary, the internal portion remains, throughout life, morphologically like testes (male) tissue. Women excrete on the average about 70 per cent as much male hormones as do men, and presumably they arise in this male tissue. During the development of the male sex glands —the testes—the outer (female) portion loses its female appearance early. Nevertheless men produce on the average about 40 per cent as much female hormones as women do. Presumably these hormones arise from the residual female tissue which remains as a part of the testis tissue.

As a result of the androgynic character of animals, certain remarkable transformations have been brought about, particularly in fowls. In some species of birds it is common for only one ovary to develop functionally in females and to produce all the egg cells, while the other ovary remains quiescent. Authentic cases have been cited in which the functioning ovary of a fowl has become diseased so that she ceased to be able to produce eggs; later, however, the cortical tissue of the other ovary developed and became a testis, capable of producing male sperm cells, and the fowl took on male appearance and characteristics. The fowl (she-he) was at one stage in its existence a mother, and later a father.[5]

In the human species true hermaphrodites who are unequivocably

both male and female are extremely rare—only about twenty cases are on record. In only three of these was there an ovary on one side and a testis on the other; usually the glands are mixed, ovarian and testicular tissues being associated in the same structure. Much more common is so-called male pseudohermaphroditism, in which the individual has male sex glands and is therefore a male, but presumably because of abnormal hormone production (and resulting feminization) has many female secondary sex characteristics, such as absence of growth of hair on body and face, high-pitched voice, feminine figure, etc. In these cases the production of female sex hormones has for some reason predominated over the production of male hormones.

Such unfortunate cases represent an extreme condition which, however, is in keeping with the idea that each of us is a mixture of maleness and femaleness. There are all gradations between the hermaphrodite and people whom we regard as normally male or female. The normal males and females are mixtures not only with respect to their secretion of male and female sex hormones but also with respect to the possession of masculine and feminine traits. However, maleness and femaleness are not single factors by any means, and an individual therefore may be masculine in one or more respects and be feminine in other ways.

For purposes of illustration let us list the following traits which with fair accuracy may be recognized as belonging more to one sex than the other.

Traits Which Are Predominantly Male	*Traits Which Are Predominantly Female*
muscularity	gracefulness
prominence of larynx	inconspicuousness of larynx
hairiness of face	possession of a "skin you love to touch"
low pitch of voice	high pitch of voice
callousness	sensitiveness
mathematical inclination	love of music and art
lower degree of emotionality	higher degree of emotionality
uncommunicativeness	talkativeness

The traits in one column or the other are not, however, consistently found together in the same person. Masculine and feminine traits may readily be possessed by the same individual. A man with a very prominent larynx may be exceedingly fond of music or a woman who is very emotional may have more than the normal amount of hair on her face. Both males and females are complex mixtures possessing various masculine and feminine characteristics to varying degrees. This is in keeping with the fact that there are several male and several female sex hormones and complex interrelationships with other glands.

The fact that so-called male and female traits and abilities are so inconsistently possessed by representatives of the respective sexes has been made the basis of a powerful and valid appeal, on the part of the anthropologist Margaret Mead, for society to recognize this fact and allow individuals to develop the abilities and leanings which they may possess without social stigma, regardless of whether they are males or females.[6]

When a woman is less feminine than the average, we may say that she is mannish, and when a man is less masculine than his fellows, he may be labeled a sissy. Nature is probably wise, however, in endowing people with both types of traits. It is very questionable whether a 100 per cent male and a 100 per cent female could get along together. This is an entirely hypothetical question since no such individuals ever existed. Any man who boasts that he is a 100 per cent he-man must, in order to substantiate his claim, bare a chest which is adorned with no telltale features and submit a sample of urine which contains no female sex hormones.

A probable result of unfortunate hormonal aberrations is so-called homosexuality which exists in several forms and which according to some authorities affects to a greater or lesser degree as many as 5 per cent of the population. Studies have indicated that in certain types of such individuals there is an abnormal ratio between the amounts of male and female sex hormones excreted. While it is not possible at present to recognize such individuals by an analysis of their hormone secretion, they constitute a serious social prob-

lem, and it seems highly probable that a more thorough study of the secretion of the various hormones would result in means whereby they could be recognized. Better yet, it seems probable that they may be successfully treated. At the present time not all of the pertinent hormones that influence sex are known chemically and the best methods for determination or assay involve determination of several together. It is possible that further chemical and physiological advance will have to be made before anything of material value can be done for such individuals. Some reports, however, are optimistic.[7]

6

There are probably a good many instances in which hormones or hormone-like substances are involved in the body mechanism, in addition to the better known hormones.*

Among the examples of borderline phenomena of this sort are hunger and the emotions such as fear and anger. When an individual has the sensation of being hungry, it is found there is an accompaniment of typical hunger contractions in the stomach, which can be observed by X-ray. These come and go with the sensation of hunger. In dogs it has been found by experiment that blood transfused from a starving dog to a normal one will induce typical hunger contractions in the normal dog for a normal period of time—ten to thirty minutes. Something similar in function to a hormone has evidently been released into the blood of the starving dog. It appears likely that there is not only a hunger hormone but also a satiation hormone which works in the opposite direction

* The more widely known endocrine glands, with the hormones they produce, are as follows: intestinal mucosa—secretin, cholecystokinin, enterogastrone; pancreas—insulin; thyroid—thyroid hormone (containing thyroxin); parathyroid—parathormone; adrenal medulla—adrenaline; adrenal cortex—corticosterone, etc.; testis—testosterone, androsterone, etc.; ovary—estradiol, estriol, estrone; corpus luteum—progesterone; pituitary—growth hormone, prolactin, thyreotropic hormone, parathyreotropic hormone, corticotropic hormone, pancreatropic hormone, fat metabolism, gonadotropic (sex) hormones.

because when the blood of a recently fed dog is transfused into a starving one, the stomach contractions in the starving dog are abolished for a period of five to six hours. Other evidence that the secretion of digestive juices and the contractions in the intestine are controlled by hormones is found in experiments in which intestinal tissue is transplanted and severed from all its nerve connections; in this case it may contract and secrete periodically and keep pace with the stomach although nerve connections are entirely lacking.[8]

That strong emotions release hormone-like agents is indicated by the fact that the normal secretion of gastric juice and the normal stomach and intestinal movements (peristalsis) which accompany digestion are promptly abolished in dogs and cats for a considerable period of time when they become highly excited. It is well known that strong emotional states such as grief, fright or anger banish hunger and may upset the whole gastrointestinal system. Serious stomach disorders may arise because of continual anxiety and fear and this is not inexplicable when we realize how readily emotional states may affect the metabolism of tissues, secretion of digestive juices and the forward movement of the gastrointestinal contents.

In emergencies involving extreme fear or anger, adrenaline is released by the medullary portion of the adrenal glands and has a number of important effects which may aid in coping with the emergency. The heart is caused to pump more forcefully, thus sending fuel and oxygen to the tissues more effectively; sugar is released into the blood to nourish the tissues; air passages to the lungs dilate permitting freer breathing, and the coagulation time of the blood is greatly decreased. The stomach and intestinal contractions and secretions cease—this phase of physiological functioning can wait until the emergency is over.

But the situation is not as simple as it may seem. It appears that adrenaline is released only during emergencies and that its action is short-lived. On the other hand, whenever the sympathetic nerves are stimulated they cause the release of another hormone-like substance, sympathin. It is similar to adrenaline in its action but not

identical. It is produced at the endings of the sympathetic nerves but its effects are not local because it is transported by the blood to adjacent areas where it may remain active for some time. The chemical nature of sympathin remains unknown; in fact, there is evidence for the existence of two different kinds of sympathin. It is probable that members of the sympathin family play important roles in connection with emotional states. Another hormone-like substance, acetyl choline, is released by parasympathetic nerves. It is a known chemical substance but its relationships to the situation under discussion are not as important as those of sympathin because, unlike sympathin, acetyl choline is readily destroyed by tissues and its effect is therefore local and transitory.

7

One of the most fundamental facts in connection with the problem of the relationship between endocrine glands and behavior is that each individual person has a set of endocrine glands which taken together act distinctively. Each person who is in any sense normal has all the working glands, but for each individual they have shapes, sizes, structures, and presumably activities, which are distinctive. For example, the human thyroid gland may vary in weight from 8 to 50 grams and is larger on the average in women. Most commonly there are actually two glands, each about two inches long, connected by an isthmus about half an inch wide. But this isthmus is often absent or is replaced by a strand of connective tissues; the shapes of the lobes differ and they may or may not be mixed with tissue from the near-by thymus gland. The thymus gland may have additional thyroid tissue embedded in it.

The same type of variation is observed in other glands and is reflected in a variability of activity. In the case of the thyroid, which releases a single hormone, there is a wide divergence of activity and many people have glands that are substantially above or below average in the amount of hormone they release. Only the extreme

cases receive medical treatment. In severe cases overactive glands are partially removed by surgery and in cases of glands with too low activity thyroid from an animal source may be fed to make up for the deficiency. Most of us, however, accept our thyroid glands and our other glands just as we accept our facial features, and make the best of the particular assortment that nature has provided.

Pituitary glands in different individuals do not vary as widely in gross size as do thyroid glands but they differ markedly in structure. The best available information indicates that for normal adult males the glands vary in weight from about 350 to 800 milligrams. There is some tendency for the glands to increase in size with stature. In women they are larger on the average and increase in size with succeeding pregnancies. The gland hangs by a stalk in a small cavity almost in the exact center of the head. It consists of three main parts, the fore part (anterior lobe), the hind part (posterior lobe), and the middle part (pars intermedia). The latter is made up partly of colloid material and partly epithelium. The fore part is of greatest importance in the production of hormones.

The range of distribution of the various parts of normal pituitaries is as follows:[9]

	Per Cent		*Per Cent*	
Anterior lobe	56.00	to	92.00	of the whole
Posterior lobe	7.10	to	41.30	of the whole
Epithelium (pars intermedia)	0.13	to	3.64	of the whole
Colloid (pars intermedia)	0.02	to	10.39	of the whole

Microscopic studies of the cellular make-up of the anterior lobe show that it is made up of roughly three kinds of cells: acidophiles (acid staining), basophiles (base staining), and chromophobes (non-staining). A study of the distribution of these different types of cells in normal pituitaries shows that 37 to 64 per cent are chromophobes, 23 to 43 per cent are acidophiles, and 9 to 27 per cent are basophiles. Each of these types of cells, which vary widely in their relative numbers, has its own peculiar functions and in some cases evidence is available as to which types of cells are in-

volved in the production of specific hormones—for example, the acidophile cells produce the growth hormone. There is evidence that the chromophobe cells should not be lumped together as one kind but actually are of more than one type. Every investigator who has studied pituitary glands has noted the wide diversity of the specimens obtainable from normal individuals. Many specimens have been obtained for study from normal men who have met accidental death.

In view of the fact that the pituitary gland is made up of several types of structures with several kinds of cells in each, and since it has many functions—producing many independent hormones—it is not so surprising that its gross size does not vary through extremely wide limits. Because of irregularities of form there is room for very wide divergence in the structures producing individual hormones. In the case of glands which produce a single hormone it is quite customary and proper to speak of them as being overactive or underactive. To speak of the pituitary gland as being overactive or underactive is, however, meaningless unless one has in mind a specific hormone. There is every reason to think that an individual pituitary gland may be overactive in producing one hormone, underactive with respect to another, and of average activity in the production of a third.

Without going into further detail we may say broadly that each individual possesses a set of endocrine glands which is distinctive in the size of the different types of structures and the numbers of specific kinds of cells. Presumably cells of the same size may also vary in their tendency to produce hormones, and in addition the responsiveness of individuals to the hormones produced is by no means uniform.

We should not leave the subject of individual variation in endocrine glands without suggesting the importance of overactivity or underactivity in the sex glands. There are wide differences in these structures and a high degree of variability in the sex drive should be expected.

Standards of what may be regarded as a normal sex life prac-

tically do not exist, because of the intimate nature of the necessary information and the emotional and personal aspects of individual behavior. Underactivity of the sex glands in both males and females is widespread and well known in medical practice. Overactivity is recognized less often, partly because a strong sex drive is considered normal. Illegal and excessive indulgence, and even criminal indulgence is blamed on human nature rather than upon the nature of the individual human being concerned. Probably it would be an exaggeration to say that if the sex drive of some individuals were rated in terms of horsepower, that of others should be measured in terms of mousepower, but there can be no reasonable doubt of wide divergencies. This oversexed condition is known as satyriasis or nymphomania, but there is comparatively little knowledge as to what causes it or what, if anything, can be done about it.

Since sex drives are among the things which we do not measure, we do not know how individuals compare with one another or whether the intensity of the sex urge is directly related to the rapidity with which the urge returns after it is satisfied. An intensive study of hormone excretion may tell us much that we do not know. A fact which emphasizes the complexity of the problem and the great possibilities of individual variation is that while removal of the sex glands in males (castration) usually diminishes the sex drive it does not always abolish it. Eunuchs may have sex urge, and cases have been reported in which they were able to copulate as long as twenty-five years after castration.[10] In such cases there must be hormones promoting sex drive arising from tissues other than the testes. In all, there are a number of aspects to sex activity and a number of hormones and endocrine glands that may be involved.

Variability also exists in phenomena in which the operation of hormones is probable but not fully recognized. Competent authorities believe that there is a wide divergence in individuals in the complex functioning of the autonomic nervous system, which regulates most of our vital functions without our conscious effort. We

have already indicated the hormone-like principles which appear to be involved in these processes.

Although the mind has in general no direct control over the work of the autonomic system—we have no method whereby we can consciously send a message to our kidneys or liver—there is by no means a complete barrier between our higher thought centers and the impulses which travel to and from our internal organs. In this, also, individuals appear to differ widely. In some the autonomic nervous system tends to go its own way, working smoothly and relatively undisturbed by thought processes and seldom impinging upon the mental life of the individual. In others, however, the barriers are relatively weak (or the impulses strong) with the result that the functioning of the internal organs is greatly affected by the mind and probably also greatly affect the mind. Difficulties in the functioning of the internal organs tend to register themselves as a diffuse awareness of something wrong, with a result that worry and anxiety may result. Anxiety, fear, anger and similar emotions are more intense in some individuals than in others and this probably affects the autonomic nervous system and internal organs in varying degrees.

This subject is an involved one and no one has more than a sketchy and somewhat speculative picture of the various interactions.

8

It should be reasonably clear to everyone who considers the subject that inasmuch as we may inherit from our forebears factors which determine the color of our skin, hair and eyes, our facial features, the lengths of our fingers and toes, etc., so we should also expect to inherit factors which would determine the general size, shape and activities of our endocrine glands. This does not mean of course that no modification can take place through influences which exist during our lives.

Evidence on the question of inheritance of endocrine character-

istics by human beings is certainly not contrary to this assumption; neither does it appear to be very definite or extensive. In connection with animals, however, there have been many interesting and conclusive experiments and observations.

For example, Riddle has found that one hereditary strain of doves required twenty times as much prolactin to elicit a response as did another strain of doves. This indicates that susceptibility to the effects of a hormone are inherited. (Prolactin in doves and pigeons causes the secretion of crop milk with which the young are fed.) Also he was able to produce by selective breeding two strains of doves, one characterized by having large thyroid glands, the other small thyroids. Stockard's investigations with dogs have shown that they belong to endocrine types and these types are hereditary.

A striking example of hereditary transmission of endocrine tendency is that of dwarf mice which have pituitary glands entirely lacking in acidophile cells. The acidophile cells are the ones which produce the growth-promoting hormone and the hereditary dwarfed condition of the mice is due to the lack of this hormone. When growth hormone preparations are administered to the dwarf mice they grow to the size of ordinary mice.[11]

There are no serious doubts that individual human beings inherit endocrine tendencies as they do peculiarities of metabolism and many other bodily features. The inheritance of what appears to be a single tendency may, however, involve a number of heritable factors, and the investigation of the genetic relationships is not simple.

9

We have already encountered numerous examples in which it seems obvious that the hormonal pattern would have a great influence on the behavior or personality of the individual. The study of the relationships between endocrine glands and personality is a difficult and largely unworked field.

Hoskins correctly appraises the situation when he says in connection with the pituitary gland, "For the most part, endocrinologists who have been concerned with the pituitary have been little interested in the psychological aspects of the subject. Conversely few well-trained psychologists have found their productive interests in the endocrine field." A study of endocrine-personality relationships must involve competent consideration of both the endocrine phase and the psychological phase. If either phase is neglected or weak the whole investigation collapses.

Possibly the most serious available study of the relationship of glands to personality is that of Freeman who made autopsy studies on the glands of 1400 psychotic patients dying at St. Elizabeth's Hospital in Washington, D. C., over a period of ten years.[12] He classifies individuals into four fundamental personality types—cycloid, paranoid, schizoid, and epileptoid. The cycloid is "extroverted, industrious, subject to fluctuations in mood, athletic and highly sexed." The paranoid is "reserved, suspicious, antagonistic, embittered and calculating." The schizoid is "introverted, retiring, self-deprecatory, studious, meticulous and low in physical vitality." The epileptoid is "moody, pedantic, devout and subject to paroxysmal headaches, rages, fits." On the basis of weighing the endocrine glands of the 1400 psychotic patients who could be placed in these groups, he could find little relationship between the comparative weights of any gland and the personality types of the owners. The most suggestive relationship which he found was with respect to the weight of the testes of the male patients. The weights varied from 10 to 45 grams and large testes were found to be associated to a considerable extent with schizoid personalities. Somewhat incidentally, he made the interesting observation, by comparing the characteristics of those possessing large and small testicles, that the possession of large testicles was associated with circulatory death, hirsutism, bald crown and homosexuality, whereas the possession of small testicles was associated with large hips, gynecomastia (mammary development), hairless body.

A serious limitation of this study is the fact that the fundamental personality types listed are not ones which psychologists generally could accept. There are several characteristics under each classification which may be combined in one individual; for example, a person could be highly sexed, suspicious, retiring and moody, and so have one characteristic from each of the four types. The possession of each of the component personality traits catalogued was not arrived at objectively. Too much on the psychological side was left to opinion and judgment. There would be a much better chance to find revealing relationships between endocrine glands and personality if the various types of cells, in the pituitary for example, were considered separately rather than if merely the weight of the whole gland were determined. Such a procedure would have added enormously to the task involved in the research and it is doubtful whether, using the fundamental personality types as a basis, any very clear-cut results would have been obtained. Here again, however, it is safe to conclude that the relationships between endocrine glands and personality are not simple.

In this connection it may be cited that Cushing examined postmortem seventy pituitary glands from psychotic patients in state hospitals without finding what he considered a single normal gland. Excessive amounts of connective tissue was often present or there was an abnormal assortment of cell types, but he was not able to discover a correlation between the type of abnormality found and the type of psychosis involved.[13]

Personality traits in animals have been studied from the endocrine point of view with interesting results. It was noted for example that certain rats under controlled conditions involving fear tended to defecate and urinate, whereas other rats under exactly the same conditions remained calm and self-controlled. The two types of rats were kept separately and by inbreeding it was found that the tendencies were inherited, and that the emotional and the fearless rats constituted two independent strains. When the glands of rats from these strains were compared, it was found that the emotional rats

had markedly larger adrenal, thyroid and pituitary glands than the fearless rats. It should be noted in this case that the psychological trait which was the basis of the investigation was definite, and was not a hodge-podge of traits.

In our discussion of the relationship of endocrines to personality and behavior we have sought to avoid false implications with regard to the *control* of personality by hormones. It is clear in many cases that the presence or absence of a hormone will influence the behavior of the individual. However, the means whereby hormones are released are imperfectly understood, as are the possibilities of variable susceptibility. We are not acquainted with the degree of control which the higher thought centers may have on endocrine activity and effectiveness, and are not in a position to enthrone the endocrine glands to the extent of regarding them as the sole occupants of the driver's seat.

10

Our rapid survey of some of the known facts regarding endocrine glands and their functioning reinforces and emphasizes the importance of individuality and the futility of expecting every human being to behave in accordance with a pattern which we ascribe to the average man.

While our knowledge of the endocrine glands and their activities is fragmentary, the existence of a large variety of endocrine patterns in different individuals is certain. Heredity plays an important role in determining one's endocrine pattern and this in turn is an important factor in behavior. We need more adequate knowledge as to how individuals differ from one another with respect to endocrine glands, and we need to do our social thinking in terms of individuals who differ widely from each other. Problems of sex and marriage, for example, cannot be solved as long as we think only in terms of average individuals.

Available knowledge about hormones and their physiological and psychological effect does not make the problem of personality

simple, and the discovery of correlations between endocrine features and personality characteristics constitutes a fertile and productive field for investigation. In order to consider this problem more seriously we must be in a position to deal with psychological capacities and traits. These will be treated in the following chapter.

VII. Psychological Traits and Capacities

Nature never rhymes her children nor makes two men alike.

R. W. EMERSON

THE PURPOSES OF HUMANICS as outlined in the first chapter of this book are related to those of the scientific psychologist but still they differ fundamentally. The psychologist is interested in "getting to the bottom of things" so far as the working of the mind is concerned and as a thorough-going scientist he must have no special bias or purpose other than to find and understand the truth. Such an attitude is absolutely fundamental to progress and the type of study which we are advocating has everything to gain from a strong and well-developed psychology. But the humanicist, if we may call him such, has an ax to grind; he is interested in the type of psychological and other knowledge that can be *used* and *applied* to social betterment.

From some standpoints it is regrettable, but on the other hand it is entirely natural, that the general public should be more interested in science which accomplishes things than it is in pure science which is devoted to the love of learning for its own sake. Pure psychology has suffered from lack of support for the reason that it has been concerned with discovering the fundamentals of the mind. When psychology devotes itself to industrial or social purposes and is able to develop measures that have practical utility, then the general public pricks up its ears. Of course the practical measures develop entirely out of purely scientific findings—but the public does not

always appreciate this. The tremendous value of psychology in World War II, when it becomes more fully known, will be a potent stimulus to popular support in future years.

The basis on which we are advocating the study of human beings is entirely practical and unless useful and valuable results come from it, it will have missed its mark entirely. The distinction between a pure science and a practical study is illustrated by the contrast between a chemist who is the fundamental scientist engaged in studying atoms and molecules and the details of their transformations, and the applied technologist who may be interested, let us say, in extending the uses of wood and in an improvement of its qualities. The technologist must build upon the work of the fundamental scientist but his purposes are quite different.

2

Our concern about psychological capacities and traits is then a practical concern—about characteristics that have or may have important applications in everyday affairs, and in affairs which are perhaps not so common but are nevertheless important for public welfare. Let us turn to the psychologists for help.

Titchener was the first to emphasize early in this century the possibility of analyzing mental activity to the point where the indivisible mental factors might be recognized and dealt with. He compared the work of the psychologist with that of the chemist and thought of mental activities as complex or composite in nature, and capable of being broken down into elements in much the same way that the chemist is able to break down a complex chemical substance into its constituent elements.

Experience since Titchener's time has showed that this idea, while a laudable one, is too ambitious to be brought to fruition within the foreseeable future, simply because there are too many mental elements intertwined in what may superficially appear to be a relatively simple mental process. Our knowledge of inheritance and

the number of genes (and cytoplasmic factors) which must be concerned shows that the particular assortment of characters which each of us has obtained from his forebears is composed of an enormous number of units. A search for fundamental psychological elements could hardly be successful without a recognition of these inheritance factors.

Many attempts have been made by psychologists to analyze the various traits which men may possess. Allport and Odbert, for example, have collected and published all of the English words, principally adjectives, that may be used to designate more or less distinctive behavior. The total number of trait names found was 17,953. Of these about 25 per cent were truly designations for persistent traits, rather than for momentary states of mind or mood or words carrying an implied judgment regarding desirability or undesirability.[1] There are approximately three hundred traits or supposed traits for which psychological tests have been devised; among these there are a number of near duplications and many which are so composite as to make their significance highly questionable.

Kelley narrowed the field to relatively few traits of outstanding importance. He did not have our objective in mind—discrete psychological characteristics that are of social importance—and some of his traits are therefore of too general a nature; e.g., "a social trait" and "a general factor." Even sex was considered as a trait.[2]

The most recent of many attempts to classify traits is that of R. B. Cattell who made an exhaustive and mathematical study to determine the personality traits which are primary. He fully recognizes the necessary limitations of his type of investigation when he says, "The objective test is obviously the only scientifically acceptable foundation, for establishing traits, but for factor analysis it suffers from the severe disadvantage that even a set of tests deliberately devised to be very diverse, may tap only a small angle of the personality." Because of this limitation he relied not upon objective tests, but upon behavior ratings by individuals, as his fundamental data.[3]

Some of Cattell's traits are included in the discussion below but

others are of too general a nature to be useful for our purpose; for instance, "intelligence" and "positive character integration." He was concerned with personality traits, which are not necessarily identical with the psychological characteristics we are seeking. It seems that in order to discover and establish fundamental psychological characteristics it will be necessary in the nature of the case to study personalities by objective means and not to rely on a study of descriptive terms which happen to be already at hand. In natural sciences phenomena are usually recognized and described first; the coining of names to designate the phenomena comes later and usually offers little difficulty. It also seems likely that in the search for psychological elements there has been too much emphasis on statistical studies and too little upon *intensive investigation of individual human beings*. The individuals possess the characteristic traits and if the traits are real they should be discoverable *where they exist*. Their distribution throughout the population is an important item, but this can be ascertained after they are recognized.

We shall make use of all of these psychological contributions and others, particularly Thurstone's outstanding work on primary mental abilities, in our attempts to outline those characteristics which appear to be of greatest social importance.[4]

It is entirely appropriate that in developing this practical applied science we take cognizance, wherever necessary, of ordinary traits such as are recognizable by the layman. The use of common designations for these, even at the risk of appearing unscientific, is also justified. The technologist who deals with wood, for example, does not hesitate to consider its grain, its hardness, its tendency to split, its ability to stand wear and take a finish. These are qualities that the man on the street may recognize; they are not the result of exacting scientific analysis, yet they are nonetheless important so far as the uses of wood are concerned.

Even for the purposes of scientific psychology at least one member of the profession (G. W. Allport) has voiced his opposition to the tendency of his fellows to belittle the common-sense approach. He says, "In common speech everyone presupposes traits when he char-

acterizes himself or his acquaintances. This man, one says, is *gruff* and *reticent* but a *hard worker;* that man is *fastidious, talkative* and *penurious.* Normally the psychologist too talks in these terms. But as soon as he enters his laboratory or classroom he is likely to leave common sense behind him and embrace one or another of the [highly technical] scientific theories. . . . Rightly he thinks of common sense as a faulty guide. Yet in the matter of human traits common sense is remarkably well-seasoned with experience, and scarcely deserves the complete rebuff it receives." [5]

To select those characteristics which are highly important from the standpoint of humanics is a difficult task and any effort which I may make to do so will be wholly on a tentative basis. The characteristics should show promise of being important from the social point of view; they should be as measurable and as independent of each other as possible. Such characteristics probably will not be, in the scientific sense, elementary and indivisible; they will be complexes and many of them will have elements in common. As I make clear in later chapters the development of the science of man will be an effort of vast proportions, and far-reaching in its effects. Any attempt made here to analyze and select important traits or characteristics will be merely preliminary and suggestive, and not too closely tied to the highly technical aspects of psychology.

Psychological characteristics may have social importance for one or more of the following reasons: (1) they may be directly involved in the harmonious relations within and between human groups of all sizes; (2) they may be intellectually essential to social progress and advancement; (3) they may be emotionally invaluable in the enrichment of life; (4) they may make possible the performance of occupational tasks. In brief, people need to be *harmonious, intelligent, artistic* (in the broad sense) and *practical,* and the traits and capacities which are most important from our standpoint are those that contribute to these four categories.

The idea that any one single characteristic is so outstandingly important as to be enthroned above all others is not only scientifically erroneous but in some cases vicious. The concept of gen-

eral intelligence has undoubted practical utility, particularly as a measure of ability to accept formal scholastic training; it is useful, though not infallible, in the segregation of morons, imbeciles and idiots. But general intelligence is a catch-all phrase; it is not one capacity but several, and to emphasize it as a single endowment is to do violence to the scientific facts. Furthermore if general intelligence ratings are used in connection with individuals who are considered normal or above, they are liable to create an unhealthy psychological attitude on the part of those whose scores are either below or above average—involving loss of morale on the one hand and creation of cockiness and conceit on the other. A thoroughly scientific approach to the problem of intelligence largely obviates this difficulty, in accordance with later discussions.

3

Drives. Before we can deal properly with the other psychological characteristics or traits of individuals we shall have to discuss certain inescapable factors which often are physiological in nature—namely, the drives or motivations which lie behind behavior.

By the study of the behavior of animals it is possible to gain insight into these factors. Hunger is one of the drives which causes experimental rats to become active. Approximately every four hours they become active for some minutes, then if food is available they eat and cease their activity. That the sex urge is also a drive causing activity is readily shown in the case of a female rat kept in a rotating drum so that its activity can be recorded. The estrus cycle occurs every four or five days, and regularly coinciding with estrus there is an increased bodily activity of 50 to 100 per cent.

A study of hunger-driven, thirst-driven, sex-driven and exploration-driven activities of rats indicates that the first two types of activities were highly variable in that a particular rat which seemed to be highly responsive to hunger or thirst at one time would not necessarily respond well at another time even though the condi-

tions were supposedly the same. This might be interpreted to mean that the hunger and thirst drives are fluctuating in their intensity and that valid comparisons are therefore difficult to make. On the other hand individual rats were more consistent with respect to the sex urge and the urge to explore, and tended to have the respective urges to about the same degree at different times.[6]

The same fundamental drives which affect the behavior of experimental animals also affect the behavior of human beings, but in human beings the psychological aspects of the motivation become so complex that they are difficult to analyze. *General vitality, sex urge* and *thirst for knowledge* (investigative) are drives of a very general nature which are of great importance from the standpoint of our interest. These and other motivations have physiological as well as psychological bases which are complex and their interrelations are not clear. Psychological motivations may involve numerous cultural factors as well as the abilities of the individual. An individual may lack a drive to learn to play the piano because he has no aptitude for music or because such activity is not looked upon with approval by his family and friends. On the other hand if the individual's aptitude for music is strong enough and his general vitality great enough, the cultural influences may be completely overcome.

Motivations will enter as factors in several of the characteristics listed below, some of which are expressive in nature.

4

a. Expansiveness and Reclusiveness.[7] This pair of opposing traits is one of the easiest to recognize and to rate with certainty and consistency. The expansive person always makes himself known, gives the world the full benefit of his thoughts and makes it difficult for people to ignore him. The opposing tendency (and there are all gradations in between) is exemplified by the person who draws into his shell like a clam, keeps his thoughts to himself, and allows himself to be ignored, even though he may have good ideas.

These qualities are related to those of talkativeness and gregariousness. They are observed even in young children and tend to persist throughout life. There is nothing fundamentally good about one trait or bad about the other. People who are reclusive can remark with justification that this would be a boring world indeed if everyone were expansive, and those who are expansive can with equal justification point to the uninteresting world which would exist if everyone were clam-like. Fortunately most people lie between the extremes—between the urban dweller who is into everything, day in and night out, and the hermit who lives most contentedly in a mountain cabin wrapped in his own solitude.

Expansiveness can, especially when extreme, be highly annoying and hence is a very important trait from the social standpoint. Cason in his study of several hundred causes for personal annoyance has listed about a dozen that were selected by a group of people as being particularly irritating.[8] Of these, six are all closely related to expansiveness: habitual arguing, crowding in front in a line, speaking in a dictatorial manner, putting hands on unnecessarily, boisterousness, attracting attention in public, and continual criticizing. In order to call attention to the importance of expansiveness the reader is asked to think of the people whom he most thoroughly dislikes. How many of them are quiet-mannered, with a habit of tending to their own business?

b. Persistence and Changeableness. These contrary traits are not as clear-cut and probably not as widespread as are expansiveness and reclusiveness. For children and others who are characterized by immaturity there appears to be a general tendency toward perseverance or the opposite, but for mature individuals whether they persevere or not depends upon the task concerned and the motivation behind it. In general, one is more likely to persevere in a task if it is not so easy as to be boring or so difficult as to be almost impossible. The individual's ability comes into play and it is difficult to construct tests which may be applied in a wholesale manner.

Probably both habit and fundamental inheritance come into play in these traits. They are somewhat related to the problem of funda-

mental vitality and tendency toward fatigue; very likely there are individuals who are constitutionally unable to show extreme perseverance in any activity. Fortunately there are those who show a remarkable persistence and may hold a job which involves the repetition of a useful routine task for many years at a stretch. Such individuals, who in a sense are the salt of the earth, must have the capacity for persistence and at the same time the task must be suited to their abilities. A mind which is capable of solving intricate problems does not readily adjust itself to a routine in which its abilities are not called into play at all.

Again we are not justified in extolling one trait and depreciating the other. While persistence has its place, changeableness and restlessness have their place also. If everyone had the trait of persisting doggedly at the task assigned him, the whole world would be a series of ruts and there would be no climbing out.

c. Dominance and Submission. These opposing traits belong to the same general group as those already discussed, and like perseverance and its opposite are not of general application but change somewhat from situation to situation. Usually when two people have extensive dealings with one another, one of them tends to dominate, have his way, and win the arguments while the other tends to be submissive and conciliatory. The one who agrees and placates may indirectly gain his point by this very means, but the dominant and submissive roles are still observed. In marital relationships and others, troubles arise when two dominant personalities come into conflict and when neither can assume the submissive role.

While certain individuals tend toward dominance in all their relations throughout childhood and adult life, they nevertheless may in the presence of an individual who for some reason is more dominant than themselves (an employer, a wife or even a child) assume perfectly the submissive role. From the standpoint of their value to society, submission is not desirable and dominance undesirable, or vice versa. If everyone were dominant there would be no one to dominate, and if all were submissive there would be no one to submit to. The conflicts which arise out of the collision of

dominant traits are highly important in social organization, and it is desirable that we know more about how these traits arise and how they can be turned into constructive rather than destructive channels. This subject will be touched on further in later chapters.

d. Strong and Weak Emotions. People not only differ in that some have their emotions more readily aroused by music, others by art, others by sex, etc., but some have a high emotional capacity and others do not. There are individuals whose emotions are never aroused to a high intensity by any cause while in others the emotions are easily stirred. Irritability and sensitiveness are sometimes listed as psychological traits. These are related to the emotions and are closely linked with physiological functioning.

Attempts have been made to measure emotional responses by noting blood pressure changes, changes in pulse rate, and electrical responses from the skin. One of the difficulties involved is the apparent tendency of individuals under experimental conditions to mask the emotions and thus to produce spurious results. Further research coupled with avoidance of attempting studies on a wholesale basis should make these associated traits measurable. It is extremely doubtful whether an individual who is easily angered is necessarily also easily frightened and easily elated. Probably when we attempt to measure the emotions all together the results are unavoidably confusing.

Emotions enrich life tremendously and hence are extremely valuable. On the other hand if one is excessively emotional he may be miserable a considerable portion of the time. Unfortunately the emotions of fear and anger can be excessive just as can the pleasurable emotions.

A factor of great importance in connection with the study of emotions is that most individuals probably have emotional cycles which cause them to have their ups and downs, independent of any outward events in their lives. According to R. B. Hersey, who has made an extensive study of this subject, people's emotions most often rise and fall every thirty-three to thirty-six days though about 40 per cent have decidedly shorter or longer cycles. These emotional

cycles are discovered by watching and recording one's own moods and in the case of women the emotional cycle is said to be superimposed upon the menstrual cycle.[9]

It seems probable that there is wide variability in different individuals in the *intensity* of their emotional fluctuations. Common observation tells us that some people are often depressed or elated and that others have more even temperaments. What is sorely needed in the study of emotional cycles is objective means, probably physiological, whereby it will be possible to determine one's emotional state. Relying on introspection and one's own estimate of his feelings is unsatisfactory at best. If the emotional cycles referred to cause pronounced changes in an appreciable number of individuals, this is a phase which needs to be explored very early in the scientific study of any individual specimen, because there is no predicting how widespread the effects of the emotional cycles may be. Many physiological and psychological tendencies and capabilities may be markedly affected.

e. Ability to Memorize Rote Material.*[4] Among the mental traits or abilities which are relatively easy to recognize is the ability to remember such items as numbers, words, and letters in a rote fashion without particular regard for any meaningful associations. This is one of the primary mental abilities as developed in Thurstone's valuable study. This study involved giving a series of fifty-six sets of psychological tests to 240 students and analyzing the results mathematically in order to recognize the primary abilities which entered into the performance of the tests. This rote-memory ability stood out as one of the definite mental traits which an individual may have to a greater or lesser degree *independently of his possession of other abilities.*

This trait is a desirable one in that it is useful in numerous everyday activities and may be of great use in learning foreign languages. The knowledge of foreign languages, on which is based the intercommunication and development of understanding between peoples,

* The items listed under e, f, g, h, i, j, k and l are supposed to constitute basic inheritable capacities.

is of tremendous social importance. Rote memory is only one of the abilities required in learning a foreign tongue, but there is no effective substitute for it in developing a large vocabulary.

Individuals who have other highly developed abilities may be weak in this and their activities are restricted to a greater or lesser degree. However, many men and women who have achieved greatness have doubtless been largely lacking in this ability. It is not *primary* in the sense of being basic to other mental activities.

f. Facility with Numbers. This is another of Thurstone's primary mental abilities, and may be possessed in varying degrees in the absence or presence of other traits. Persons having a high score on rote memory may have a low score on facility with numbers and vice versa.

It is not at all unusual for persons who are inclined toward literature to be definitely disinclined toward mathematics and the reverse may also be true. The late William Lyon Phelps confessed that in mathematics he was "slow but *not* sure." Willard Gibbs, the American genius in the field of mathematical physics and chemistry, revealed his attitude and his lack of inclination toward literary expression when he made his only speech in a meeting of the Yale faculty. The subject being discussed had to do with language and mathematics. He arose, spoke four words, "Mathematics is a language," and sat down.

These cases are cited not to indicate that there are any necessarily opposing qualities in mathematics and language or literature. Some individuals possess aptitudes in both directions to high degrees. It is of importance, however, that we recognize the existence of a number of mental traits which may be possessed or not, independent of the possession of others.

g. Spatial and Visual Imagery. Another relatively clear-cut mental trait is the capacity to visualize all sorts of objects in two or three dimensions and deal with them in the imagination. It may be measured by testing the ability to distinguish and recognize pictures of right and left hands, regardless of unusual positions; to imagine the placing of a series of irregular geometrical forms together to

produce a cube, and to visualize the operation of a set of gears and determine from the direction of movement of one the direction of movement of another distantly related to it. This trait is closely related to mechanical intelligence.

Such ability is invaluable and indispensable in some phases of mathematics, engineering, physics and chemistry. However, there are phases of mathematics, such as algebraic transformations and number theory, where this aptitude does not enter, and all branches of chemistry and physics do not involve this ability. From the standpoint of mechanical and scientific advancement in arts and industry visual imagery is of great importance socially. However, it is fortunately by no means a necessary prerequisite for social usefulness.

h. Word Familiarity. This primary mental ability has to do with recognition of words; building anagrams and recognizing correct spellings were important tests used in discovering its existence. Visual and spatial factors seem to have entered because all the tests involved printed rather than spoken words. This ability is conspicuously absent in some individuals who may be intellectually very able in other ways—they are poor spellers to whom the spelling of a word, right or wrong, is a matter of indifference. Since this ability is one which enters into the use and learning of languages it is socially important but it is not essential that everyone possess it. According to the analysis its possession is not correlated highly with the possession of any other mental trait.

i. Manipulative Use of Words to Convey Ideas. This ability, according to Thurstone's study, is distinct from what we have called word familiarity above and has to do with the meanings of words and the ideas which they convey. An individual may excel at spelling and recognizing words but be deficient in knowing their meanings or grasping the ideas they convey. On the other hand an effective user of words may be a poor speller. Because of its application in the production and use of all types of literature including scientific writings the social importance of being able to use words would be difficult to exaggerate. It is worth noting that the ability

as discovered, pertained to written or printed words, and not to facility of speech which involves other abilities already mentioned. A person may have a strong aptitude for manipulation and use of words in written form, but may be inept at expressing his thoughts orally.

j. Inductive Formulation of General Principles. The ability to see a general principle when confronted with a series of specific facts is apparently another special capacity which may or may not be possessed irrespective of one's other mental abilities or deficiencies. It is essentially inductive reasoning, which Francis Bacon is sometimes given the credit for fathering, and is exemplified by Newton's discovery of the universal law of gravitation and Darwin's development of the doctrine of evolution. It is exceedingly important in science and in all thought, and derives its social value from this. It certainly is not important that everyone have the ability. Those who are of the dreamer type are essential for the advancement of learning, but the formulation of generalizations is not the sort of activity which enters into the every-day life of a large percentage of the population.

There may be a wide range of strength in the tendency which various individuals possess for formulating generalizations. The capacity is related to the ability to deal with abstractions and probably helps to determine one's attitude toward a subject such as philosophy. Among my acquaintances are two individuals who have many interests in common in that they have done a similar type of scientific work. One is strongly inclined toward philosophizing and dealing with abstractions, while the other thinks philosophy is pure nonsense. Another scientific worker of my acquaintance is so strongly bent toward abstract thinking that it is often impossible for him to get down to earth (in terms of one who is less inclined to abstract thought) so as to make himself understood by those whose pattern of thought is different. He tends to avoid restricted non-controvertible statements in favor of those that are general and universal in scope. To him a specific phenomenon is hardly worthy of mention—it is notable only when it seems to

have general meaning and to fall in line with the broad concepts and abstractions entertained in his mind.

A common failing on the part of some is to have an urge to formulate generalizations, even though they lack the ability to arrive at conclusions that are commonly acceptable as valid. Such people are liable to make sweeping and premature generalizations —for example, about the characteristics of Orientals, Japanese, Westerners, New Yorkers, and so on.

k. Deduction of Particulars—Applying General Principles. This ability (essentially deductive reasoning) according to Thurstone's study appeared to be a primary mental element; that is, it seemed to be a mental trait the possession of which was relatively independent of the possession of others. Its use is exemplified by the work-a-day activities of a lawyer who must be able to apply the general principles and statements of law to the specific cases with which he is concerned. In mathematics or in any other field where there are recognized axioms or supposedly fundamental truths, deduction is common. It is a favorite method of authoritarians in general and is used more or less in all fields of knowledge.

l. Perceptual Facility. This primary mental ability as originally described by Thurstone consists in readily perceiving detail that is embedded in irrelevant material; for example, finding a particular word in a page of print. To the writer it seems that this ability may be based to a considerable extent upon excellence of peripheral vision and other similar factors and if so it should not be classed primarily as a *mental* ability.

m. Intuition—Creativeness—Common Sense.* Admittedly these do not constitute a single independent trait, nor does it appear likely that individually or collectively they can be measured with a high degree of satisfaction on the basis of present knowledge. On the other hand there appears to be something very real and very important which we may associate with these terms.

Possibly the most convincing evidence in favor of the existence

* The items from this point on are different in scope from those included in the group e to l inclusive.

and importance of intuition as a mental ability may be found in connection with the lives and works of great leaders in art, music, literature, science and religion. No one would be disposed to question that Bach, for example, was able by some process which still appears mysterious to produce music which has been able to attract and hold the attention and affection of human beings for centuries and probably will for many centuries to come. Since the ability which he possessed cannot well be attributed to inductive reasoning, spatial imagery or any other of the primary mental abilities listed above, it may well be set in a separate category of intuition or creativeness. To say that it has not been analyzed further scientifically is not to say that it cannot be. It is not unrelated to common sense, to be discussed below, because of the universality of its appeal.

Probably the outstanding abilities of William Shakespeare, of Michael Angelo, and of Louis Pasteur could be placed in the same classification. Pasteur seemed to be able again and again to arrive at valid conceptions long before he had experimental proof. His creativeness lay in his ability to formulate hypotheses that turned out on the basis of his own hard work and enthusiasm to be tremendously productive. In the case of all great leaders in art, music, and literature the ability to create material which has a widespread appeal is most significant.

For the purposes of this discussion and avoiding all theological disputation, we may say that Jesus' teaching arose by intuition. Certainly none of the previously mentioned mental abilities could be held responsible. Even if we recognize and exaggerate the opportunities which he had for learning from his forebears and others, his selection and enunciation of the fundamental laws of life indicate an ability to draw upon a Universal Mind, which does not fall within the abilities previously considered. The universality is the feature which makes the ability of such outstanding importance—the fact that after many centuries, minds of the highest quality still pore over his words and obtain from them ideas that are applicable to modern life.

Intuition, however, can encompass error as well. The typical

paranoiac has the unshakable intuition that he is being consistently persecuted although the intuition has absolutely no basis in fact. The inmate of an asylum may have the intuition that he is Napoleon Bonaparte or the religious fanatic may have the intuition that he has a special message or insight from the Deity. Intuitors may grasp universal truth or beauty, they may grasp utter nonsense, or they may grasp a mixture of the two. Intuition that has not proved itself by a discriminating wide appeal is not to be trusted.

It is often claimed that women are more intuitive than men. They are said to be more observant of people beginning at childhood, and to develop intuitive judgments based upon these observations. There appears, however, to be nothing in the extensive study of Terman and Miles on sex and personality to show how valid this idea is.

It is an interesting observation, if justified, that women who are circumspect in other particulars will indulge freely in smuggling without any pangs of conscience. It may be that this is due to an intuitive lack of respect for laws such as tariffs which are highly artificial in nature and are not based upon a moral code.

The *common* thing about common sense is its wide appeal. Unless an idea is such as to gain extensive acceptance it cannot be regarded a common sense idea. The possession of common sense would not appear to be a simple trait; it is related to intuitiveness and probably has a number of components. In science common sense, being intuitive in nature, is not a safe guide. It has to be tested by experiment. Sometimes ideas which appear to be obviously true cannot be trusted. For example, even the axiom that a straight line is the shortest distance between two points is not true on the surface of the sphere. Here the shortest distance is a curved line.

One aspect of common sense involves having intellectual perspective, being able to put things—regardless of how unusual—into their proper places. This is probably closely related to the mental abilities involving inductive and deductive reasoning. Another aspect of common sense is related to tact, which will be mentioned later.

If we classify as intuitive all the contributions to art, music,

literature, philosophy, science and religion which cannot be accounted for on the basis of the primary mental abilities already listed, then the importance of intuition in human life is almost beyond exaggeration. However, that intuitions are not always to be trusted and have led to innumerable errors cannot be denied.

n. Orderliness. This trait, while probably not as important from our standpoint as some to be discussed later, is nevertheless reasonably clear-cut and fairly generalized. That is, a person who tends to be meticulous about his or her personal apparel and its care tends to be orderly in handling correspondence and in the care and disposition of books and papers in the library or study. Some women are naturally good housekeepers and take pleasure in having the household shipshape. Others are indifferent so long as they can successfully make their way from one room to the next without mishap. Men also have a divergence of traits in the same manner and when a man who is extremely meticulous and old maidish about such matters marries a woman who is slipshod in her housekeeping, the marriage can end in shipwreck. A man who is fussy about having everything just so cannot endure having the baby's pot left on the dining-room table.

This trait may be more important than we think, particularly in the conduct of organizations and their meetings. I have often noted a wide divergence of attitude on the part of different individuals with respect to this. Some feel that orderliness and regularity of procedure are matters of first importance, even if the wishes of the group have to be violated. Others tend to go to the other extreme and are quite willing to disregard all formalities, so as to get to the root of the problem under consideration. Those who are for orderliness are the type who want to have things arranged ahead of time—who is to make the motion, who is to second it, etc. Even in a meeting of such import as the 1945 San Francisco Conference of the United Nations, differences of attitude of this sort appeared. It has not been demonstrated that orderliness in the conduct of a meeting is associated with a tendency in orderliness toward dress or housekeeping but it is not improbable that there is some relation.

Doubtless training can do much to alter one's pattern of behavior; on the other hand orderliness is probably to a considerable extent an inherited trait. Often in the same household one child may appear to be naturally orderly and neat in his behavior from early youth, whereas another child raised in the same surroundings may be as consistently disorderly. Of course, each child in a family inherits a distinctive set of traits.

o. Co-operative Imagination—Empathy. If you should see in moving pictures a man swaying on the cornice of a skyscraper and should unconsciously try to help him by tightening your grip or by twisting or leaning in an appropriate direction, you would be exhibiting empathy. A more commonplace example is one's tendency to laugh when he sees or hears others laughing, even though he may not know what the laughter is about.

This tendency, which may be of considerable importance, has apparently never been studied extensively as a trait, but it appears to be one which is possessed in variable degrees by different individuals. If one takes snapshots of spectators during a tense moment in an athletic contest one may note that some appear to be trying to help the team push the ball over the goal line or to help the jumper get over the high-jump bar; others, who appear to be equally attentive, sit with unchanged posture. Similar differences between individuals may be noted when, for example, different onlookers observe another person replacing an automobile tire or lining up the wheel of a bicycle. The watcher who has strong empathy will immediately know when another hand is needed and what help is required, whereas the person lacking empathy will wait to be asked for help and then may help in the wrong way. Still another example may be observed in connection with musicians. Some are natural accompanists probably because they possess empathy; others in spite of being excellent musicians simply do not have the capacity to adapt their performance so as to be in rapport with the soloist.

Empathy probably has an intimate relationship to certain types of crowd psychology. In order for a group of persons to constitute a psychological crowd they must have their attention centered on a

common object. They become aware, by various means, of each other's attitudes toward the object (which may be a person) and it seems reasonable to suppose that empathy comes into play. We say a speaker sways a crowd or carries it along with him. His gestures if effective may incite empathy on the part of individuals, and the individuals in the group may incite empathy in each other. The presence of critical persons who react against the speaker, however, also has an empathic influence which tends to prevent the crowd from acting as a unit.

p. Suggestibility. Like many of the other traits which we have discussed this can hardly be considered as an independent one. It seems to be closely related, for example, to empathy, which has just been discussed. Its importance and the importance with which it has been viewed by social psychologists makes it worthy of discussion. It is probably not highly generalized, in that individuals may be suggestible along certain lines and not suggestible along others. Doubtless, it is greatly influenced by training.

The fact remains that some individuals from childhood on tend to be easily led and easily influenced by suggestion. The mere existence of the common adjectives *tractable* and *docile* and their application to children and adults is evidence that this is so. During childhood and youth suggestion by parents, teachers and others comes into play continuously and is closely related to the phenomenon of learning. It is largely by suggestion that the customs and mores of one generation are passed on to the next, and is highly desirable from the standpoint of maintaining decorum that children should be suggestible. Fortunately and even ideally adults should also show a measure of suggestibility; otherwise they cannot accept and follow leadership and co-ordination of human activities becomes difficult or impossible.

From the standpoint of the welfare of society it seems that neither extreme suggestibility nor extreme resistance to suggestion is desirable. When people in large numbers "Vote for McGinty" or "Buy Laxitate after Thirty-eight" simply because the idea has been suggested to them by placards, billboards and radio plugs, too much suggestibility is demonstrated. That people are often easily subject

to suggestion has been demonstrated by circulating utterly foolish petitions and noting the ease with which signatures are obtained. Highly suggestible people make effective mobs and will follow a leader without qualm or question.

It is perhaps easy to exaggerate the prevalence of suggestibility of people as a whole, and the tendency to sign petitions indiscriminately may be due in part to excessive politeness and desire not to offend the persons who are circulating them. Public opinion polls often tend to give one confidence in public judgment, when there is no trickery or coercion involved.

At the opposite extreme in suggestibility we may consider a group of university professors who, in accordance with the investigative spirit which they must have, are critical of everybody and everything. If one of their number presents an appealing proposal to their assembled group, regardless of how trivial it may be, there is a tendency to pick it to pieces and point out every possible flaw or complicating contingency. Not infrequently hours of valuable time are spent in the detailed analysis of inconsequential matters, primarily because of the extreme resistance to suggestion and unwillingness to follow leadership. In large deliberative bodies of critical people such as legislatures, congresses, etc., this resistance to leadership has often been overcome in a practical manner by referring many matters to committees. The committees are small, tend to submit to leadership, and often, in effect, make decisions on relatively important matters.

As individuals we doubtless tend to be more suggestible if the suggestion is in line with our previous thoughts or in accordance with our wishes. A person whom we have learned to respect can effectively suggest an idea or proposal, whereas the same proposal coming from a person whom we do not hold in high regard will meet immediate rejection. Each of us no doubt accepts suggestions most readily when we are led to think of them as coming from our favorite self rather than from any outsider.

q. Introversion and Extroversion. When a person's interest is in the objective world around him, he is said to be extroverted; when everything he observes tends to be considered and evaluated in

terms of himself, he is introverted. No one is wholly introverted and no one wholly extroverted, but these opposing characteristics are possessed by each individual in varying degrees.

The typical extrovert is interested in his work, tends to be expansive, is undaunted by failure and thick-skinned in his attitude toward the opinions of others. The typical introvert, on the other hand, is interested in his own thoughts, tends to be reclusive and is very sensitive to the opinions of others and to their criticism or praise. Either trait when possessed to a moderate degree is valuable from the standpoint of society.

Pride is undoubtedly closely related to introversion as is also the tendency to react unfavorably toward criticism. Both tendencies have a very general distribution, but on the other hand there is a high degree of variability. Some individuals can accept and make use of criticism and suggestion while others freeze up inside as a result of it. Some have a desire to see themselves as their neighbors see them, but in others this desire is comparatively weak.

An unwillingness to face one's own limitations squarely is probably the result of faulty mental hygiene. One can be trained from childhood to suspect that he has weaknesses that must be concealed, in which case deception including self-deception is the logical defense. By a more wholesome approach, one recognizes his strong points in which he can take pride and faces his possession of weaknesses as the common lot of all mankind.

Most of the tests which have been devised for measuring introversion-extroversion tendencies have been in the form of questionnaires which while not ideal are nevertheless reasonably satisfactory for this purpose.

r. Altruism and Egoism. These traits are related to extroversion and introversion and are of great importance from the standpoint of social welfare. There are people who consistently modify their conduct to accord with the interests of others and there are people who seem never to be concerned with any interests but their own. The trait is not perfectly generalized by any means: an individual

may not be uniformly altruistic or uniformly egoistic. An egoistic person may expand his egoism to include a few others, as the man who prayed, "God bless me and my wife, my son John and his wife; us four and no more." Sometimes the egoism is expanded to include the members of a larger social group.

Closely related to egoism is competitiveness. We find individuals who always think of their own status and their own progress in terms of competition, while others, more fortunately disposed, are able to be more objective and concentrate less attention on their own fortunes. The same trait adds zest to competitive games and recreations and is valuable in many activities. There are people who are so lacking in it that they play games apathetically and when the playing is over it does not even occur to them to add up the score. These characteristics are probably related to introversion and extroversion.

Even the highest religious ideal exemplified in the commandment, "Love thy neighbor as thyself," does not involve complete altruism. Love of self is not denied or even subordinated to the love of others. The ideal social attitude is not one which excludes self, but includes self in a larger "we."

Since altruism is a trait which has social approval, nominally at least, it would not seem feasible to measure it by a questionnaire. If one is asked about his interest in others, he is likely to respond in accordance with the dictates of social approval rather than reveal his true attitudes. More subtle methods must be used.

5. Self-Objectification. This trait has in it some of the elements that are present in extroversion and altruism. Socrates said, "I must first know myself." He revealed an introverted urge coupled with an extroverted attitude—a desire to examine and study himself but also a desire to step outside himself to make the examination. Burns's

> Oh wad some power the giftie gie us
> To see oursels as ithers see us!

is a familiar quotation embodying something of the same idea.

The best method that has been devised to determine how well

a person knows himself is to have him rated both by himself and his associates with respect to various traits. If his own estimates of his abilities and traits agree well with the estimates of his associates, this is an indication that he at least knows himself as he is known. If there is a wide disparity, then it appears obvious that the person is deluded with respect to himself. A radio wag has said of such a person, "I'd like to buy him for what I think of him and sell him for what he thinks of himself."

Very closely related to the ability to know ourselves is the ability to laugh at ourselves. A person who takes himself too seriously is suffering from self-deception. Everyone has his own failings and his own weaknesses and a person who thinks he is exempt is deluded. Curiously the large proportion of people who have been asked think that they know themselves rather well, whereas tests show that their traits as seen through their own eyes check poorly with their traits as seen by their associates.

t. Devotion and Loyalty. Capacity for loyalty and devotion has not often been considered as a distinct trait by psychologists, but its mention appears justified because of its social importance. One reason for thinking that this is a trait which is not only distinctive but inherited is its apparent hereditary possession by animals.

Certain breeds of dogs possess it and others seem to be almost wholly lacking in it. Literature is full of stories of dogs that have pined at their master's graves. Yet, dogs do not always have this sense of devotion. I know of an adult cocker spaniel, for example, which was sold and transferred to a new master without difficulty. Later upon encountering his former master the dog seemed to be entirely indifferent to him. Some dogs by inheritance make good watchdogs and will jealously guard the home from the approach of all outsiders, even friendly ones, whereas others are so lacking in this trait that they would greet a burglar as a prospective playmate.

If it is a distinctive human trait to possess loyalty, and if this trait is possessed in varying degrees by different individuals, this is a

fact which society needs to know. It would help in understanding the role which followers play in social and political movements. They, as well as leaders, can be fanatical.

Jealousy may be compounded of egoism and loyalty and is often observed in intense form even among very young children, as well as animal pets. Our erstwhile neighbors had a terrier with an extremely jealous disposition. He would carry on excessively if he saw any acquaintance, especially his master or mistress, paying any attention to another dog or to a cat. When he strayed in the neighborhood a sure way of bringing him home in a hurry if the direct approach—calling him—didn't work, was for his mistress to call either the neighbor's dog or cat. He would come bounding immediately.

It is interesting and notable that different individuals and different animals have this trait in widely varying degrees.

u. Acquisitiveness. This trait is by no means equally distributed throughout the human family. Some take great pride in ownership; others are relatively indifferent to it. Some let human relationships be subservient to acquisitiveness, such as the person who deliberately marries for money, but to others acquisition of money or goods remains of secondary importance. If some individuals were deprived of the incentive of laying by something for old age, they would miss much of life. Others would prefer to leave this to Santa Claus or to the government. Some find a pleasurable outlet in collecting postage stamps or any one of a thousand other things. Some are acquisitive in their imaginations only. Not a few carry on imaginary stock market operations and keep careful books on their holdings. While some individuals delight in such hobbies, others by nature lack the inclination and are indifferent.

One of the reasons for thinking acquisitiveness is a real trait is that we find it inherited in exaggerated form in certain species of animals. Some are born collectors. One of the most striking of these is the mountain rat or pack rat, which will take to its abode every imaginable type of article, unusual pebbles, pieces of glass, coins, spoons, door knobs, etc. It has even been known to carry off sticks

of dynamite to the nest. These articles are stored and presumably are periodically admired just as a collection of pottery might be.

v. Psychic Tempo. We know relatively little about the time factor in mental life. That different individuals have distinctive sets of physiological reaction times is clear, but the relation of these to mental activity is not. It is a commonplace observation that some people are quick on the trigger with their ideas whereas others have minds which act more slowly. The general experience of psychologists is that in the conduct of ordinary psychological tests, the relative standings of the testees do not differ very materially whether the testees are given a longer or shorter time; those who can make a high score do so whether the time is relatively long or relatively short. The Army Alpha test used so extensively in the First World War was conducted on a rigid time schedule, and lengthening the time probably would not have improved it as a means of picking and sorting soldiers. However, in some psychological tests as well as in many intricate life situations, in which the solver of the problem must formulate the problem as well as find the answer, time for deliberation is important. Ability to deliberate does not necessarily go with ability to give rapid answers. In thinking as in other things the race may not always go to the swift.

There is another aspect of the relation of time to mental activity. Some people seem to have a sense of time which others lack. People who have this always know the approximate hour of the day and can judge with accuracy how long it will take them to do an errand or transact a matter of business. They can always be punctual if they care to and have relatively little difficulty in holding to a schedule. At the other extreme might be cited an example of a husband who volunteered to me good naturedly a number of instances to prove that his wife "had absolutely no conception of time." It would be interesting to know whether this trait is related to the sense of timing in music or the ability to judge accurately the passage of short intervals of time.

w. Dramatic Tendency. The liking for make-believe and for display is, I suppose, to some extent inherent in everyone, but in some

of us it is distinctive enough to be characterized as a trait. It may often be notable in very young girls, to whom it is as natural to be coquettish and demure by turns as it is to eat and sleep. Not all young women and girls, however, possess or are able to acquire this ability, nor is the tendency limited to the female sex.

The same justification which has been mentioned in connection with other traits may be cited in this case. The dramatic tendency appears to be inherent in certain species of animals. Sea lions are perhaps the most natural showmen. They love to learn and do tricks to attract attention and will fight for the chance to show off. It is interesting, too, that they are often extremely jealous, and that jealousy is frequently observed among theatrical and other folk whose primary interest is in exhibitionism in some form. Sea lions work together best in a troupe of three or four—each one doing his own special tricks. Each one thus has a chance to show off what he can do, unmolested and without direct competition. How much like human beings!

x. Miscellaneous Traits. No claim can be made that the list of traits and characteristics which we have presented is complete. We have omitted some in spite of the fact that they have received attention from some psychologists, because they appear to be composite in nature. Tact, which is often mentioned as a trait, is an example. It appears to be made up possibly of intuitive common sense, empathy, extroversion, and submissiveness.

There are several psychological traits which are known to be possessed by relatively few people. Among these is color hearing or synesthesia which involves seeing colors whenever music tones are heard. No two synesthetes agree on the correspondence between the colors and pitches but for them it is a very real experience. As they advance in age, the ability deteriorates. Another ability called eidetic imagery is possessed by some children. They have such vivid visual imagery that they can project an image on a surface in front of them and see it in detail and color.

Still more interesting, but belonging in the field of controversy, is the possible existence of some individuals who have clairvoyant,

mind-reading, or similar abilities. A revival of interest in this field has developed particularly at Duke University where a large number of experiments have been reported which seem to indicate that these phenomena are existent.[10]

One of the difficult phases connected with these purported demonstrations is the fact that when these powers are looked for in many people they turn up missing. On the other hand, in specific cases data have been obtained which are hard to explain away. Our discussions make it seem reasonable for these powers, *if such exist,* to be possessed by relatively few, and the apparent observation that the powers come into play only under favorable psychological conditions is not unreasonable, though it does greatly magnify the difficulty of making a conclusive demonstration.

5

It is important for us to realize that the fundamental or primary psychological capacities are possessed independently of each other. Many of the traits listed above are doubtless not primary or fundamental, and in a number of cases interrelations have been noted. Some of the characteristics, however, are more nearly primary than others. In the case of several of the mental capacities or abilities which are more measurable, it is easy to present convincing evidence that each alone may be possessed independently—that is, largely in the absence of other mental abilities.

The existence of so-called idiot-savants is extremely interesting in this connection. They are individuals who according to ordinary educational standards are feeble-minded and range down, by ordinary tests, from morons through imbeciles to idiots. Yet they remain living testimonials to the invalidity of ordinary tests as measures of total intelligence, because some of them have remarkable mental powers.[11]

To take a relatively easy-to-believe case, a young man of twenty-one was found by intelligence test to be a low-grade moron, but

it was observed that he could fix and put together with facility door-locks, bicycle bells and almost any mechanical contrivance. He was given the Stenquist Mechanical Aptitude Test and instead of having the mental age of a small child, he was, in mechanical aptitude, a superior adult. Testing this man for his primary mental abilities would result in discovering that in some phases of intelligence, particularly those which are indispensable for book-learning, he was very weak but that in some other respects (at least one, and possibly more) he was strong. There are recorded a considerable number of feeble-minded people who, like this one, have had striking mechanical ability. Some such have developed into highly skilled wood carvers.

An interesting authentic anecdote illustrates the irregularities in human make-up. A school principal took a feeble-minded youth to a special clinic for examination. Among the tests applied was a structural visualization test involving fitting together irregularly cut segments of a block. This test was completed by the feeble-minded boy in one minute. For the principal who brought him, on the other hand, it took "eighteen minutes of unhappy fumbling to do the test!"[12]

One of the most common mental abilities to be found among those classified as feeble-minded is the possession of an outstanding memory. A feeble-minded boy in an Ohio town memorized the telephone directory and the automobile license numbers of many of the citizens and would show off his ability for audiences by giving telephone numbers and license numbers when requested. An imbecile in Texas specialized on vital statistics. Upon meeting a person the imbecile would ask the date of his birth, those of his father and mother, the dates of their death, his wife's maiden name, and would gather any other information of this kind that he could. Years later he would meet the same individual and give him the complete details with accuracy. His memory was so perfect that he was consulted when the county records were found not to be clear.

The possession of such remarkable memories can probably be accounted for partly on the basis of a very good memory endow-

ment, supplemented by concentrated training in the absence of distraction. Such an individual may have relatively few things on his mind, and because a display of his memory ability brings approbation and attention he is motivated to devote himself to it almost exclusively. Possibly the relative vacancy of his mind in other regards makes possible the retention of enormous amounts of memorized detail. Possibly the principle implied by the mythical icthyology professor holds: he announced to his beginning class that he would not try to learn their names because every time he learned a new student's name, he forgot the name of a fish.

Another type of mental ability which may be possessed in spite of the relative absence of several other mental abilities is that involved in arithmetical calculations. A boy of sixteen was so mentally deficient that he had never learned to talk; in fact he was not able to respond correctly when requested to point to his eyes or ears. At an early age he had taken an interest in written numbers and scribbled them whenever he had an opportunity. If one placed before him the first members of a series of numbers such as 2, 4, 8, 16, 32 he would write correctly the succeeding members of the series 64, 128, 256, 512, and so on. When confronted with the series 2, 4, 16, each member of which is the square of the preceding member, he wrote 256, 65,536 and 4,294,967,296, which are correct for the three succeeding members of this series. He got the idea of square roots from seeing numbers and their square roots written side by side, and could also perform this operation mentally.

Another boy of twelve (an imbecile on the basis of general intelligence tests) was able to multiply two three-digit numbers "with lightning rapidity." Another when told the age of a person could respond correctly telling the number of minutes the person had lived. One imbecile girl was very efficient in multiplication and division but would fail on simple additions. Another high-grade imbecile could, if given any date within the previous five years, state correctly the day of the week it fell on, "without hesitation."

One of the types of outstanding abilities most often observed in

feeble-minded people is along artistic lines, including music. One of the earlier recorded idiot-savants was an imbecile named Gottfried Mind who was born in Germany in 1768. He never learned to read or write nor could he gain a knowledge of the value of money, yet his ability in drawing and in making water-color sketches gave him considerable fame in Europe.

The proportion of feeble-minded who have some appreciable gift for music is considerable; they can be found in almost any state institution where feeble-minded patients are kept. Even those who are farthest down the line in mentality may have some gift. An idiot girl of fifteen has impaired eyesight and can hardly speak; however, even with a spasticity in her fingers that makes the mechanics difficult, she can play simple tunes on the piano, by ear. A number of feeble-minded have been highly gifted in music. Among the more famous examples is that of Blind Tom, an imbecile who was an accomplished pianist and gave many recitals. After his public performances he joined with the audience in applause. Blind Joe was a similar character who appeared in vaudeville.

We have dwelt upon these feeble-minded individuals who have some unusual mental abilities because they demonstrate the independence of the different types of mental abilities. Not all of them are phenomenally gifted by any means. There are all gradations and not infrequently a feeble-minded person will be approximately average in several respects but of course to be classed as feeble-minded he would have to be weak in some of the capacities which are indispensable in intelligence tests.

Idiot-savants are simply extreme caricatures of you and me and our neighbors and friends. They are strong in some traits and weak in others; if some kinds of tests are applied, they appear very weak, other tests make them appear strong. The same is true of all of us, but as psychological testing is usually carried out these ups and downs are overlooked. Too much is lumped together and called general intelligence. For purposes of predicting school behavior (on the basis of schools substantially as they are at present) conventional tests are generally successful but unless they involve testing for a

series of separate capacities, they overlook the significant fact that *individuals possess different mental abilities in highly variable degrees.*

To classify members of the human family as either intelligent or dumb may be convenient for some purposes, but it is not justified by the scientific facts. Much less is it justified to classify individuals in the upper ranges as smart, smarter and smartest. With respect to number facility, individuals can be classified in this way with some accuracy. With regard to ability to memorize rote material we differ greatly and it would be relatively easy by arranging a series of contests to decide who is the most able person *in rote memory* in each county in the United States. Or we can rate people with respect to their ability as spellers (word familiarity). But when it comes to total intelligence we cannot be rated 1, 2, 3, etc., any more than we could rate in the same classification Shetland ponies, race horses and draft horses.

Men whom we regard as brilliant are not necessarily brilliant in every respect. It is not detracting from Albert Einstein as a mathematical physicist to say that as a youngster he was so slow in learning to talk that they feared he was abnormal. There is no reason for thinking that Einstein's mind is *in every respect* phenomenal. Would the reader venture the guess that he excels (1) in word familiarity, (2) in rote memory, (3) in spatial imagery, and (4) in number facility? I would not. Even with regard to number facility alone, the case is not clear; there are plenty of good mathematicians who are relatively poor in mental arithmetic and from some stories that are told of Einstein's boyhood it would appear that he belongs in this group.[18]

To assume that the different mental abilities are tied together and that an individual's mental capacity acts as a unit and inevitably belongs somewhere on the scale between highest intelligence and complete idiocy is as childish and unjustified as it is to assume that every individual must belong somewhere in the scale: (1) very good, (2) good, (3) fair, (4) bad, (5) very bad. Neither type of classification is at all justified by the scientific facts.

6

The total personality of an individual comprises many different items and is not limited to the purely psychological. Allport suggests as an ultra-simple definition that personality is "what a man really is." We may expand this wording slightly and say that personality is the sum total of all of the characteristics and traits that go to make a distinctive individual.

How thoroughly we wish to study a personality will be determined by the extent and character of our interest. If the thesis of this book is a sound one, and if we need to know ourselves *thoroughly,* a superficial view of personality will not suffice. For some purposes, say the hiring of a waitress to fill in during a summer vacation, there are comparatively few things that one would need to observe or know; her manner and appearance—face and figure; her manual dexterity in handling dishes and food, and her observance of ordinary property rights. But if the building of a successful society is a serious undertaking and is worth painstaking effort our interest in human beings will be deeper than this and we will develop tools which will make it possible to probe deeply into any personality when the occasion demands it. We should be able to study individuals with something of the same thoroughness that we study the steel that enters into our machinery, buildings, bridges and dams, and the plastics we have learned to create.

On the basis of present-day knowledge and using tools which are at least in the making at the present time, a *thorough* study of a human personality would include a consideration not only of bodily build, facial features, etc., but also many features of internal physiology, sensory equipment and its functioning, and finally an assay of the various mental capacities and traits. Among the items not commonly thought of in this connection are: peripheral visual fields; metabolic features (such as tendency to ketosis); drug responses; brain waves; appreciation of design and color; musical

aptitudes—timing, pitch, consonance, emotional reaction; talkativeness; peculiarities of sleep physiology; not to mention the several separate mental capacities and the numerous psychological traits which can be measured with some success.

Of the various elements which enter into the total personality of an individual, the psychological ones are of outstanding importance from the social standpoint. A person's body build, metabolic peculiarities, brain waves, breathing pattern, etc., are relatively unimportant items *of themselves,* so far as his social contacts are concerned, in comparison with what goes on in his mind. But the psychological characteristics of an individual are often difficult to recognize and analyze and to measure with any degree of certainty, whereas physiological and metabolic characteristics may be more definite and far easier to measure.

Every consideration leads us to think that psychological phenomena have physiological bases, and many physiological attributes of personality are eminently worthy of study *because of the light which they will shed upon psychological characteristics.* There can be small doubt but that there is a fundamental unity between one's physiology and one's psychology, but we must extend our knowledge of individuals before the interrelations become apparent.

Instead of using psychological traits (which unfortunately are often indefinite) as a starting point, and trying to *trace them back* to their physiological origins, I propose that the alternate procedure of starting with physiological traits and *tracing them forward* also shows promise. Because of our relative lack of attention to individuals, neither method has been seriously explored; certainly an extensive study of physiological traits has never been used as a starting point for the study of an individual's psychological make-up.

Because one's psychological reactions are so overwhelmingly important in all social relations, we cannot be scientifically serious about the problem of social control and at the same time neglect to follow leads which patently are so promising, from the standpoint of contributing to an understanding of ourselves.

7

In order to test out the comprehensiveness of our present knowledge about individuals, let us consider the problem of what we know about our individual selves. Here are a few queries about oneself which are suggested by material in the foregoing chapters. Can the reader answer these with respect to himself?

Have I metabolic peculiarities that might throw light on my personality or aptitudes?

Are there certain drugs that are unusually valuable for me or others that I should avoid? If so, what are the implications? How do I react, comparatively, to tobacco and alcohol?

Do I have any exceptional vitamin requirements which should be taken into account in connection with my eating habits?

Do I have distinctive eye characteristics with respect to flicker fusion, which should affect my adjustment to moving picture entertainment, or which should call for an adjustment of this type of entertainment to me and others like me?

How acute is my peripheral vision, and what would a chart of my visual field look like? Would it throw any light on my distinctive abilities or traits?

Do fluorescent lamps of any particular type affect me adversely without my being fully aware of it?

Can I rely with any assurance upon my innate ability to be discriminating in form and design? What about color combinations?

What are my limitations and excellences in the sense of musical timing, of pitch, or of consonance, etc.?

How does my emotional response to music compare with that of others?

Do I have any striking or interesting peculiarities in my senses of smell and taste?

Am I unusually sensitive to light, noise or other sensory stimuli and is there anything I can do about it?

Does my skin temperature adjust itself rapidly or slowly and does this have a bearing on my tendency toward colds?

What is the pH of my saliva and the acidity of my gastric juice? What meaning do these distinctive characteristics have? Can they throw any light on my personality?

To which of the numerous blood groups does my blood belong and does this have significance with respect to other physiological or psychological traits?

What are my requirements, relatively, for physical exercise?

What sort of a physiological sleep rhythm applies to me, and can I better adjust myself? Or should society adjust itself to me and others who are like me?

What are my brain waves like and what do they mean? Ditto for my breathing pattern, electrocardiograph tracings and finger quivers.

How do I rate in tendency toward fear, anger, and elation, and what can I do about it?

How does my sex hormone excretion compare with that of others, and what masculine and feminine traits are strongest in me?

Am I highly, moderately or weakly sexed and does this apply only to certain aspects of sex or to all?

How am I distinctive in regard to the seven (or more) types of mental ability which people possess in varying degrees: spatial imagery, facility with numbers, word facility, etc.? How should these aptitudes influence my life and work? (A large question.)

How do my basic drives compare with those of others?

How do I compare with others in expansiveness, persistence, and dominance, and can I improve myself in these traits?

Am I far from average in the possession of empathy, loyalty, orderliness, and suggestiveness? If so, can I apply the knowledge of this fact?

Are my tendencies toward introversion, egoism, self delusion, and

acquisitiveness out of line with my ideals, and can I modify these tendencies?

I think it is safe to say that most readers will be unable to answer any substantial number of these questions. Possibly some of the questions may appear trivial but on the other hand the answers taken together could form the basis of an intelligent approach to all one's future activities.

A forward-looking society will provide for the gathering of information of this sort and we shall suggest in the later chapters of this book how such knowledge and information can make vast contributions to the practical solution of general and specific social problems.

VIII. Man and Society

While we may talk about customs and traditions of a society we must not forget that societies are composed of human beings and that all behavior, traditional or not, is individual behavior.

WOODWARD AND SUTHERLAND [1]

THE PROBLEM OF MAN'S PLACE in society is as intricate as man himself and as vast as the society in which he lives. The fact that progress in the scientific understanding of human relationships has been relatively slow should not be a matter of surprise in view of the complexity and the numerous types of factors which enter into every social situation. It is vastly more difficult to reduce human affairs to a scientific basis than it is to accomplish the same result with material things. In fact it may be taken for granted that our understanding in this field will continuously be less complete than our knowledge of non-living things. Students of society who have had the courage to attempt social analysis and who have made substantial progress in spite of the difficulty must be given an immense amount of credit.

One school of thought, however, inclines toward the position that the best that can be done is to describe society as it exists, and that to analyze it scientifically is not only hopeless but possibly undesirable. To such, the phenomena of society are outside and quite apart from the domain of natural science. One sociologist with an extreme attitude wrote a book (1943) with the leading chapter entitled "Declaration of Independence of Sociology and the Social Sciences from the Natural Sciences." [2]

If a well-ordered society can be developed on a non-scientific

basis, its development will be a strong argument in favor of this extreme view. In actuality, however, no one contends (least of all the students of society) that social advance is satisfactory or that we are sure of the road to progress. In such a predicament the answer is: "Let's try natural science (or anything else that holds promise) and see what it can accomplish."

An attack on the problem of social control from the standpoint of natural science must follow the method of natural science, which is to attempt first to understand the more elementary items that enter into complex phenomena, and progress from the known (or partially known) to the unknown—from the simpler to the more complex.

In mathematics we build our ability to solve differential equations on simple algebra. In physics we study simple motion before we attempt to study motion where complex gravitational, electrical and magnetic fields are involved. In chemistry we do not start with proteins, the most complex molecules known; we develop our knowledge of these on the basis of the simpler compounds and the elements. In biology the understanding of a complex multicellular organism is based upon a study of the cells which make up the organism. In psychology we do not logically start with the most complex phenomena first; we attempt to get at the elements which enter into the more complex phenomena.

The starting point in a scientific study of society is *man*. On the basis of logic and admittedly without specialized knowledge of the various fields, it seems that every attempt to study a problem in social science would be pursued on the basis of one of the three following assumptions: (1) human beings are at the core of this problem and in order to solve it, we must know them better; (2) the human beings that enter into this problem are already well enough known so that we can proceed to study something else; (3) while the human beings entering into this problem are imperfectly known, we must proceed as best we can without this knowledge.

There are, it seems to me, more problems which will depend for their solution on a better knowledge of human beings than is com-

monly appreciated. A scientific approach may initially involve direct study of outward events, but sooner or later it is necessary to investigate what lies behind or underneath. In natural science the chemist, for example, who wishes to produce plastics has to gain first a large body of information and insight regarding the make-up of relatively simple chemical molecules—information which has nothing to do with the property of plasticity.

2

What will be the ultimate effect on society of a better understanding of the human elements? Just how will our scientific knowledge bear fruit and in what specific ways will society be ordered differently?

While we shall in the succeeding chapters outline the answers to some of the questions in the light of specific problems, certain and dependable answers are at this time impossible. In order to promote social welfare we must depend on scientific findings and experience to guide us. The method of natural science does not involve describing our ultimate social machinery first and then developing our science to fit this machinery. Science leads the way; it does not follow.

It would have taken a superhuman prophet to have foretold at the time of the Wright brothers' experiments at Kittyhawk, what the design of the airplane of the future would be: the importance of streamlining and the modern means of generating power. *It would not have taken a prophet, however, to know that scientific study would lead to vast improvement.*

It seems certain, even though we cannot draw blueprints of the future based on a science which is as yet very poorly developed, that a better knowledge of human beings will influence all types of human activity including those involving the most elemental (animal) needs and urges such as nutrition, sleep and reproduction; those that involve activities of the work-a-day world; and those in

the realm of ideas and the enjoyment of hobbies, amusements, art, music or literature.

A knowledge of how human beings range in variability in each of the human activities will make it possible to develop systems of classification which can be used by individuals as bases for their personal adaptation. Until the ranges of variability are known and until each individual is in a position to learn at least in broad outline about his own attributes and aptitudes, there will continue to be an enormous number of misfits—cases where society is attempting to force average-sized shoes onto people whose feet are far from average.

With some activities it is possible by trial and error to arrive at a reasonably satisfactory self-classification. Obviously, for example, people are usually able to attend or stay away from art galleries (except perhaps when they are on conducted tours) in accordance with their own tastes. Often what is not wanted can be rejected. Even if we adhere to the art gallery illustration, however, there is probably a large amount of lost motion—some people attend as a matter of form or because it is fashionable to do so, while others who might gain great benefit are prevented from participating because of ignorance of themselves and failure to cultivate their inherent capabilities.

No matter what the activity is, it should be society's goal to provide for the variability which exists in that activity. If some individuals require an unusual amount of a particular vitamin, society should develop means whereby they are able to gain the necessary information regarding themselves and satisfy this demand. If the sleep physiology of individuals is sufficiently variable to demand it, society should make the information available to individuals and provide for their welfare in this respect. If it is possible for every type of individual to have hobbies that will be a source of relaxation and something to look forward to periodically, society should investigate the possibilities (based upon human variability) and make it feasible for individuals to know about themselves and to cultivate suitable interests.

We might discuss one activity after another and point out the possibilities inherent in a knowledge of individual variability and the ways in which society can furnish a basis of self-classification and a means for adjustment. In the light of our meager knowledge of individuals it would be dangerous to formulate social programs and to be highly specific as to exactly what the ultimate outcomes will be. The science of humanics must *lead the way* toward a new era in social adjustment, and to do so the science will need to grow and develop on a vast scale.

3

There are a number of reasons why the science of individuals has suffered from neglect. In the first place no one has taken the trouble to total up the numerous differences that exist and as a result there has been no common appreciation of how large and how important individual differences are, or how far afield we can go when they are neglected. Our extensive use of statistical methods has served to cover up the information about individuals which otherwise would have been evident. There is a natural and laudable tendency to take short cuts whenever possible, and it would make the study of society much more simple than it is if we could consider each individual to be the equivalent of every other individual.

An investigation within a narrow field, using a limited number of techniques, is easier than one which is broader and requires consideration from many angles. This fact has contributed greatly to the prominence of research in highly restricted fields, and to the feeling which is sometimes entertained that breadth of interest and scientific interest are incompatible.

It is a natural consequence of specialized research and the utilization of specialized techniques that social purpose should not be a prominent factor in the investigations of natural scientists. It is too much to expect that a natural scientist who continuously delves into the intricacies of cell physiology should at the same time be

an expert in fields pertaining to human relations. To a degree, therefore, natural scientists can be absolved from the blame connected with the neglect of the science of individuals.

However, the natural scientist cannot point his finger at the student of society and say, "To you belongs the blame." Has not the social scientist depended on the natural scientist for his knowledge about human beings, and is not man-in-the-abstract the biological robot, the invention of the natural scientist? Social scientists have, it seems, tended to swallow the natural scientist's concept, and if its value in social study is severely limited who is to blame?

Most of those who have considered the matter have a sense of regret and disappointment over the failure of natural scientists and social scientists to understand each other better and to co-operate for the good of all. Furthermore, there are very few, including those in social sciences, who are highly pleased with the success of social science and what it has been able to do for humanity.

In order for a better understanding to develop it is necessary for different points of view to be expressed. We need insight into each other's minds and thoughts, and any sincere attempt to make clear what our plight is or to evolve solutions should be welcome. My thoughts with respect to the relations between natural and social sciences should be viewed in this light. Whatever appeals as being constructive and sound will be accepted for what it is worth, and I hope unacceptable ideas and viewpoints, based upon my own limitations, will find as consistent rejection.

In the first place, I believe that the breach which often exists in our universities and colleges between those interested in natural sciences and those broadly interested in the problems of society is based to a considerable extent upon unrecognized psychological differences between members of the two groups. Human minds, like human bodies, do not work exactly alike and it is perfectly natural for those whose minds are built along similar lines (having similar mental capacities) to become associated in certain fields of study, and that others with different abilities should be attracted to other fields. A common mistake which we have often made (and the

concept of intelligence quotients has not helped) is to conclude, if someone thinks along lines foreign to us, that there is something wrong with his mind. Much of the scientific information which we have presented in the earlier chapters of this book should have the effect of dispelling this idea, and of making it easier for people whose minds differ markedly to work together, supplementing each other's abilities.

A highly desirable outcome is that natural and social scientists should find common purposes and work together. An important answer to this need lies immediately before us—in the study of humankind. In this there must be co-operation between the natural and social sciences, because the social scientists lack many of the necessary fundamental backgrounds and techniques. The natural scientists, on the other hand, lack the impetus and cannot without acquaintance with social problems choose those investigations which will be most germane and most helpful nor will they be able to apply their findings. Humanics, the practical science which we have been attempting to describe, needs to rally the aid and co-operation of those of every discipline.

But what hope is there of co-operation among those of such scattered interests and diverse opinions? The hope cannot be realized unless there is a unified desire—a rallying point—on which there can be a centralized interest. But we have the best of all possible rallying points—human beings—ourselves! If we cannot join in an interest in ourselves, there is no hope of co-operation. There have been strong evidences, particularly since the development of the atomic bomb, of a strong social interest on the part of natural scientists and the time seems ripe for a vigorous co-operative attack.

4

One of the difficulties standing in the way of a comprehensive attack on the problem of the nature of human beings is the organization of our universities. Often they are departmentalized so that

they are little more than a loose federation of highly specialized groups. This would make it difficult to carry out an intensive study of human beings, using diverse techniques, within the structure of a university.

The lines of separation between different departments or branches of study exist not only in the universities but also in our national research organizations. The National Academy of Sciences and the National Research Council, which grew out of it, are made up of divisions largely in line with traditional academic departments, and such type of organization would not encourage physiologists and biochemists to join hands with psychologists in the scientific study of man. The social scientists have a Social Science Research Council of their own, established later and entirely separate from the National Research Council. It includes anthropologists, economists, historians, political scientists, psychologists, sociologists and statisticians. Obviously there is no encouragement within this framework for a co-operative study by natural and social scientists of the science of humankind. In addition there is a wholly separate and comprehensive Linguistic Society of America whose interests are also germane. The American Association for the Advancement of Science is rather broad in its scope and has provision in its organization for historians, philologists and other social scientists. However, the divisions maintain their identity, and the trend is toward various specialties.

The scholars in various fields must be drawn together by some means so that efforts can be focused on the science of human beings. The way to do this is, it seems, by developing humanics as an *applied* science.

Men are too complex to be studied adequately by any one type of scientist and what is required is the attention of many experts. But this is not an unprecedented situation, and has been met with before in natural science. Wood, coal and petroleum are examples of materials which are also too complex to be dealt with comprehensively by one type of scientist and their usefulness is so prominent that they form the basis for divisions of applied science. Wood,

for example, is made up of various ingredients; celluloses, lignins, etc., and from the purely scientific standpoint this particular agglomeration of chemical substances is not of any interest. But practically wood has many important uses and scientists from various fields, physics, chemistry, botany, bacteriology, etc., co-operate to learn all of its characteristics which all have a bearing on its use. The purposes of these wood technologists are practical and their methods of attack are not limited to any academic field. The same will be true of humanicists—they will attack the problem of man's nature from any angle, in order to learn, practically, how to deal with him.

5

The idea of studying man from a broad point of view is not a new one and various suggestions and plans along this line have been presented from time to time.

On the basis of the etymology of the word (anthropos meaning man) anthropology might be considered a broad science dealing with every aspect of man. Historically, however, it had its origin in the study and measurement of ancient human skulls, and has rarely if ever stressed the complete study of present-day man. It has dealt most often with the natural history of man's origin. To quote Professor Ralph Linton, Columbia University anthropologist, "It [anthropology] became a sort of peripheral science, working in the corners and interstices not covered by the older disciplines."[3] While it is conceivable that anthropology might, by an overturn of its traditions, become an applied science concerned with the fundamentals of men's characters, this does not seem likely. It could not maintain its present identity as an academic department and the meaning of the term anthropologist would have to change materially. One existing academic branch of learning which is intimately related to an applied science of mankind is social psychology, but its status is variable and its scope too restricted for a broad scientific study of man.

There have, however, been several other modern projects and proposals directly related to the problem of the scientific study of man. Some, especially those of recent origin, will be discussed briefly.

The Institute of Human Relations at Yale University, which has been in existence for several years deriving a substantial part of its support from the Rockefeller Foundation, has as its general objective a broad approach to the study of man in his social environment. During the earlier years this institute's work was two-fold and involved (1) a frontal attack on such problems as delinquency and unemployment and (2) search for "basic principles of human behavior and social interaction." There has been a shift toward the later objective in more recent years. "The center of gravity of the program is the individual in his social setting."[4] The accomplishments of this institute have not been dramatic.

In 1937 there was published in England a valuable book, under the editorship of J. B. Cattell, called *Human Affairs*.[5] It had as its purpose the bringing together of biological, psychological and sociological materials; it was proposed as a forerunner, if well received, of a journal of the same name. Unfortunately the journal did not appear, though doubtless the oncoming war was an important factor in this connection.

An earlier journal of relatively broad scope is *Human Biology* founded by Raymond Pearl. As the name implies this journal has tended to maintain the somewhat restricted point of view of biologists, rather than to deal with the comprehensive study of man from every angle.[6]

Professor Lee R. Dice of the University of Michigan has called attention forcefully to the "importance of co-operative studies of the biology of man," and indicates that "no investigation or group of investigations now in progress is in my opinion sufficiently comprehensive to secure anything like a complete picture of man the animal, as he exists in this constantly changing world." While his own particular interest is in the field of heredity and he stresses

this aspect, it is plain that Dr. Dice had in mind a broader study which might differ from locality to locality. "Every state should in my opinion maintain and generously support a permanent center for research on man." [7] With his interest in heredity in the foreground, he says, "The study of the biology of man will be most effective, I am convinced, when a very intensive study is made of a relatively small number of families, rather than when a larger number of families is studied less intensively. In my opinion, the very best results will be secured when precisely the same families are studied from many different morphological, physiological, psychological and environmental viewpoints."

If the word *individual* were substituted for *family* in the above quotation throughout, the hereditary aspect, which must be longer range, would be omitted, but the statement would still carry an important idea. Intensive study of a few individuals can reveal much that is not apparent as a result of an extensive and superficial study of many.

Professors Brozek and Keys of the University of Minnesota have called attention to the Laboratory of Physiological Hygiene which exists at their institution and the importance of "interdisciplinary research in experimental human biology." The Minnesota institute is relatively broad in its scope and includes biochemistry and behavioral psychology. While they stress the importance of studying man in his entirety, the study of individual human beings is not stressed. They speak of "*the* individual human organism" and not of individual human organisms.[8]

In a later chapter we shall consider briefly proposals and attempts made in the medical field to center attention on individual patients, and to learn about and make use of their innate peculiarities. Psychiatrists in particular have necessarily paid unusual attention to individual differences.

No proposal to study human beings scientifically and comprehensively has as yet received any substantial public support. In spite of all the moves that have been made and all the ideas and proposals that may have been entertained or set forth, we can say that

to date there has never been developed a study of human beings which even remotely approximates comprehensiveness.

6

The applied science which we have called humanics must depend for most of its fundamental groundwork upon the *pure* sciences of biology, psychology, chemistry and physics. As these fundamental sciences develop, uncover new techniques, gain new insights and extend our information, the possibility of applications to the field of humanics increases correspondingly. It is true of every applied science that its roots are embedded in pure science, and without pure science to sustain it, its future development would be made impossible. The development of humanics will increase rather than decrease the importance of the fundamental sciences that underlie it. All that we discover in pure science about man in the abstract will be inestimably valuable.

Some of my readers, I feel sure, unconsciously exalt what they think of as the magical element in science. Actually there is no magic to the task of searching out the secrets of nature—it requires diligent and painstaking thought and effort. It may be and often is inspiring work, but it is nevertheless work—it requires extreme perseverance and stamina. Even the poet Tennyson appreciated the fact that scientific advance does not come by inspiration when he wrote, "Science moves, but slowly, slowly, creeping on from point to point." The non-scientist in general can have little conception of how often a prodigious amount of work results in a mere crumb of added information or insight.

In the field of humanics we may hope for relatively rapid advance because the idea of studying the same individual human beings intensively from various standpoints and deriving therefrom socially valuable information has never been followed. However, we will be foolish if we expect, even with pure science to fall back on, that the practical study and analysis of human beings is going to be

simple and easy. If we may refer again for purposes of illustration to the analogy between humanics and the applied science of wood technology, we may assert without fear of argument that human beings are incomparably more complex than wood. Yet success in the field of wood technology has required the work of large laboratories with well trained staffs for many years. If we are to understand human beings—a problem incomparably more important—we must be prepared to put the requisite amount of money and effort into the task. Fortunately we can reap benefits as we progress.

We must take the problem seriously if we expect our progress to be sure. This means for one thing strengthening all the basic sciences, including, as a conspicuous example, psychology. The number of psychological laboratories that are staffed and equipped to do effective research is far too small and the number of trained psychologists is wholly inadequate for the tasks that lie ahead.

IX. Humanics–Tolerance–Mental Hygiene–Religion

No man can climb out beyond the limitations of his own character.

JOHN MORLEY

WE PRIDE OURSELVES on our freedom and we should, but we need not delude ourselves into thinking that under any conditions it is by any means complete. Each of us is greatly limited in his freedom by inborn traits and abilities and accumulated habits. No one can say to himself: "Beginning tomorrow I'm going to be, and act psychologically, like a snake"—or like a goat or like a Neanderthal man. In the first place no one of us is well enough acquainted with the psychology of snakes or goats or Neanderthal men to duplicate their reactions, and it wouldn't make any difference if we were. A man can't behave entirely out of keeping with his character.

Possibly it is not desirable to stress this lack of freedom in our own self-analysis; it could be used as an excuse for not making anything out of one's life. On the other hand, it is desirable to think of the lack of freedom in others because it gives us a real and necessary basis for excusing the shortcomings which we see in them.

If a blind man should bump into one of us on the street we would beg his pardon and, knowing he could not see, it would hardly occur to us to become angry. After reading the chapter dealing with differences in sense thresholds, one probably would not become angry with another for disagreeing on the fragrance of verbenas, or the sweetness of saccharine, or the desirability of fluorescent

lights. But we are apt to become annoyed and even angry when someone holds with positiveness a contrary opinion, especially on a subject that is dear to our heart.

A person's opinion is very often the direct result of his distinctive innate mental traits supplemented by his unique experience. Most differences of opinion, even those that appear serious, are based upon these factors, rather than a difference in the intentions or the moral qualities of the disputants. It is a sad and tragic affair, which is repeated in human history ad nauseum, when two groups of equally well-intentioned people become embittered because they cannot agree on the ways and means of accomplishing common ends.

When the wind blows, we do not get mad at it; we realize that the air is following the laws that govern its nature. Likewise we should not cast blame on another person who holds an opinion that is contrary to ours—especially when the opinion is obviously entirely natural and in keeping with his past history and mental make-up.

It would be a near-miracle, for example, if a self-made man who had the push to advance from poverty to a position of influence through his own efforts should in his mature years become an active and enthusiastic advocate of a paternalistic type of government. His aggressive and self-sufficient nature and all his life's experience point unalterably in the opposite direction. It would be just as great an anomaly if a non-aggressive and dependent type of individual who was brought up to lean heavily on others were later to espouse vehemently the cause of individual initiative.

In all our internal conflicts—between liberals and conservatives, between capital and labor, between isolationists and internationalists—we are prone to incriminate our opponents, rather than to seek out the causes for their attitudes and attempt to bring about reconciliation on the basis of recognized principles or by compromise on the basis of recognized conflicting interests, and a frank appraisal of all factors involved, including the intensely human ones.

Someone has stated the golden rule in this form: "Always treat other people the way you would like to be treated, *if you were in their place*." The last clause presupposes an ability to imagine oneself in another's place. However, if the other person has mental and physiological traits which are wholly unfamiliar to you, you cannot put yourself in his place. Scientific knowledge of man is often a prerequisite for moral conduct, and humanics is, to this extent at least, an ally of morality and religion.

We may have difficulty in realizing how important mental traits are in social relations. When knowledge of individuals shall become more highly developed we will appreciate as we cannot now how two individuals having similar associations and the same books to read may, because of their mental differences, arrive at entirely different conclusions and attitudes. Such facts should make us not quite so sure that we are 100 per cent right all the time. Surely our particular assortment of mental traits and mental abilities cannot be used as a yardstick for all humanity.

Sinclair Lewis has illustrated in graphic fiction how two individuals may (because of inherent differences in mental make-up) be affected quite differently by their bringing up. Two brothers analyze their backgrounds as follows:

> "My father," said Ora, "was a sloppy, lazy, booze-hoisting old bum, and my mother didn't know much besides cooking, and she was too busy to give me much attention, and the kids I knew were a bunch of foul-mouthed loafers that used to hang around the hoboes up near the water tank, and I never had a chance to get any formal schooling, and I got thrown on my own just as a brat. So naturally I've become a sort of vagabond that can't be bored by thinking about his 'debts' to a lot of little shop-keeping lice, and I suppose I'm inclined to be lazy, and not too scrupulous about the dames and the liquor. But my early rearing did have one swell result. Brought up so unconventionally, I'll always be an Anti-Puritan. I'll never deny the joys of the flesh and the sanctity of Beauty."
>
> "And my father," said Myron, "was pretty easy-going and did like drinking and swapping stories with the Boys, and my mother was hard-driven taking care of us, and I heard a lot of filth from the hoboes up near the water tank. Maybe just sort of as a reaction, I've become almost

too much of a crank about paying debts and, fussing over my work, and being scared of liquor and women. But my rearing did have one swell result. Just by way of contrast, it made me a good, sound, old-fashioned, New England Puritan." [1] *

Admitting that this contrast may be overdrawn, it has a sound basis. Our opinions and attitudes are determined to a considerable extent by our mental abilities and traits and by the functioning of our sensory reactions and our autonomic nervous system.

2

There are almost innumerable ways in which a better knowledge of ourselves can contribute to our mental health. Knowledge of physiology has to precede its application in hygiene. Knowledge of our own mental powers and traits is essential before we can successfully apply hygienic measures to our mental life.

Personality and individuality, which each one of us unquestionably possesses, is something to be developed, not something to be leveled off and destroyed. We must know our potentialities in one or another trait or ability before we can develop them. Many conscientious people with high purposes have dealt upon themselves untold misery and frustration because they tried to develop capabilities that they did not possess; at the same time they neglected abilities that could have been developed.

Each of us has a co-ordinated distinctive assortment of a large number of traits and abilities and, as we have seen, each one of us possesses these traits and abilities in different degrees. One person is deficient in some traits and superior in others, another individual has a different assortment of deficiencies and superiorities. No one is average in every trait, no one is outstanding in all, no one is equally deficient in all.

The scientific facts about you and me should be comforting,

* From *Work of Art,* by Sinclair Lewis, copyright 1934, reprinted by permission of Doubleday and Company, Inc.

should increase our self confidence and our morale. An average man (or even one who is somewhat below average) can meet the President of the United States, a Supreme Court Justice, and a financial magnate, with the assurance that he probably excels each one of them in several desirable traits. Maybe it will be in rote memory, maybe in sense of pitch, in empathy, in appreciation of design, in word familiarity, in spatial imagery, in peripheral vision, in altruism, in sense of timing, in emotional strength, in orderliness, in loyalty or in any one or several of the dozens of traits which we possess. The realization of this should be of the greatest value to an individual, whether anyone else knows it or not, but if the realization is shared by others it can become a tremendous psychological boon. It puts a so-called average individual in a dignified position—upon a pinnacle, in fact—compared with the misleading and unscientific information that his intelligence quotient is average, namely 100.

If there were nothing whatever to be gained from study of individual human beings except a sound basis for strong morale, this alone would make it vastly worth while, because morale is all-important in connection with any activity requiring continuous effort. Harold Swift of Swift and Co. has emphasized this in connection with employees: "In my opinion the employee's chief wants are, (1) to be considered an individual, (2) to feel that he has a dignified and secure part in a worth-while enterprise, (3) to have an opportunity to think and express himself about things that are going on about him, (4) to receive a good pay check, (5) to have the privilege of being let alone to live his own life." Note that the pay check is fourth on the list and that every other item has to do with recognition as an individual.

D. J. Houser made a careful study, using trustworthy psychological techniques, of "what people want from business." In his investigations involving a number of representative business organizations he found that all types of employees from those holding executive positions on down to the laborers were very much alike in their attitudes on certain questions—they were primarily inter-

ested in matters pertaining to their own morale. Rate of pay always ranked from fifth to twelfth in importance among the various elements which made their jobs desirable, and such items as desire for recognition and personal consideration always topped the list. With regard to workers' strikes Houser says:

> It is an insult to human nature to believe that men would go into picket lines and endanger their lives in bloody violence, for the mere wages or shorter hours which unions demand. Behind every blow in every strike are days and months and years of hurt feelings over acts emphasizing men's insignificance and enforced inferiority.
>
> What the worker wants is . . . regard for his simple dignity as a man.[2] *

These observations are entirely in line with what that penetrating student of human nature, William James, had said years before: "What every genuine philosopher (every genuine man in fact) craves most is praise, although the philosophers generally call it recognition."

What is wholesome from the standpoint of those who are commonly considered the average or inferior individuals, is just as valuable for those belonging in the superior group. It would be a wholesome thing for the man of influence who is recognized for his ability, to know that should he go for a walk on any sidewalk in America the first man he might meet would probably be superior to him in some respects—superior in some of the numerous traits which are the common possession of everyone. This should not take the joy out of his life, because his abilities are nonetheless real and outstanding. Even if they were not so outstanding, he could pat himself on the back because of his ability to advance in spite of somewhat mediocre equipment.

Authorities agree that hatred is one of those reactions which are harmful both mentally and physically. It presumably releases poisons into the body, but whatever the mechanism, its bad effects are generally recognized. It is interesting that as long as one remains on

* From *What People Want from Business,* by J. D. Houser, copyright 1938, reprinted by permission of McGraw-Hill Book Company, Inc.

the beam scientifically he cannot *thoroughly* hate a fellow human being. All scientific information indicates that no human being is without desirable traits. We can let our emotions take over and hate his guts or hate the ground he walks on, but when we do this we are going contrary to the facts which science tells us. The opposite rather extreme statement of Will Rogers that he never met a man he didn't like, on the other hand, is wholly in accord with science. Everyone does have likeable features.

Many people poison themselves and waste their nervous energies in harboring jealousy. A better knowledge of human beings and the natural results of this knowledge are an antidote. It seems to me that feelings of jealousy are most readily fanned into flame, when someone *whose ability we do not recognize,* steps out ahead and receives recognition that we feel he or she does not merit. When a typist who can type a hundred words a minute gets promoted over one who can do only fifty words a minute an important cause of jealousy is absent. But if the fifty-word typist "gets her man" while the hundred-word typist goes unwanted, jealousy is a more natural result. The hundred-word typist says to herself, "What has she got that I haven't got?" If she can answer the question satisfactorily to herself, she is bound to be psychologically less disturbed. If the fifty-word typist is the prettiest girl on the staff, or if she has other evident qualities that make her popular, then the disruptive feeling of jealousy is not so liable to develop.

In professional life unfortunate feelings of jealousy seem to arise most often when some person is elevated whose ability or qualification is in doubt. If a man is clearly able to do brilliant work in a particular field, his colleagues are usually graceful in their acknowledgment but when he receives high recognition through some lucky break, when his capacity is in doubt, then stress develops.

A better knowledge of ourselves and our associates—of men in general—would tend to smooth out many of these difficulties. In the first place, if competence could be better evaluated, fewer men and women would be elevated for no good reason, and this would help tremendously. In addition, a fuller appreciation of our diverse

natures and of the numerous traits which we may possess makes it easier for us to realize that the other fellow may have obscure special abilities which fit him for a particular job, and that the boss may be in a better position to judge. In any event our morale can be salved by the knowledge that each of us can surpass our associate or competitor in some respects.

Ignorance about ourselves and our associates is, then, an important factor in the breeding of jealousy.

A more complete knowledge of ourselves can contribute in many other ways to our peace of mind. If we know what our abilities are we can know what may reasonably be expected of us. Overconscientious striving to do something that we cannot do can be avoided. A knowledge of what our limitations and our abilities are should decrease the pressure of life and make possible a more tranquil accomplishment of those things for which our gifts fit us. Those of us whose gifts are not so numerous or great should shoulder less feeling of responsibility.

3

While psychologists, psychiatrists, and students of mental hygiene could not unanimously endorse theology as a beneficial agent in human life, they would be practically unanimous in their endorsement of religion if they could specify that the religion must be the kind that engenders in human beings the triad of *faith, hope* and *love,* of which the greatest is love. These three are probably the most important mental medicines, and their opposites—fear, despair and hate—are among the worst mental poisons.

Individualism of conscience and freedom to worship has been one of the bases of our national life, and this no doubt is founded upon the Christian teaching of individual responsibility. Jesus taught this and also recognized individual differences. In the parable of the sower there were different kinds of soils; in the parable of the talents differences in endowment were recognized; in Mary and

Martha he recognized two entirely different types and was sympathetic to both; in his dealings with his followers he noted their personality differences, and in his Sermon on the Mount he admonished against judging one's fellowman.

As an outgrowth of freedom a large number of religious denominations and sects have come into existence and are a living testimony to the fact of wide individual differences in religious attitudes. Even within the Roman Catholic Church there is some room for individual differences, in the existence of the various orders. Long ago William James wrote of the varieties of religious experience and today even the most primitive itinerant evangelist knows that people differ markedly in their response to religious appeal.

Religion has a social aspect which is highly important and it is only by belonging to a group, being a part of a crowd in the psychological sense, that the greatest benefit can be obtained. From the standpoint of mental hygiene, it is essential that the individual lose himself in something bigger than himself, and belonging to a coherent group where mutual respect and love is manifest is an important means.

If the large number of denominational sects each had its characteristic qualities and each filled a need for a certain type of individual, the wastage would not be as serious as it is. Actually there are many sorry duplications and many people with religious leanings who are consistently repelled by every religious agency. One of the unfortunate traditions which it would admittedly be difficult to avoid has been that children should follow the denomination of their parents, rather than select for themselves the type of religious observance which would suit their own peculiar make-up. Children inherit and develop a mosaic of traits and aptitudes which are often very different from those possessed by either parent, and not infrequently the religious taste of a parent is quite unacceptable to the child—not because the child is bad but simply different. Partly because of intolerance within families, the social aspect of religion

is lost to many because of their lack of participation in any religious activity of a group nature.

Fortunately what many regard as the essence of religion goes marching on and the volume of religion (even what would once have been regarded as Sunday School stuff) that enters into our secular daily life is stupendous. Many of the writings in our books and magazines which are accepted without any religious connotation by people who do not regard themselves as religious, are nonetheless parables, adaptations and exemplifications of fundamental truths which were at one time regarded as religious truths.

On the assumption that the function of churches is to serve the people, it seems that the church is a natural place where individuals should come into their own and where humanics should receive active support. If churches are statistically minded and haven't time for individuals or interest in them, then they have departed a long way from their original purposes.

Better scientific knowledge of human beings should be welcomed by the churches, because by knowing people better can we help them more effectively.

Religious tolerance is traditional in our country in the sense that people have the right to belong to any church that they want to—or to none at all. This is based essentially on a regard for individuals and their religious opinions and attitudes. More of this same tolerance and appreciation of individuality could well be exhibited within family groups and within church groups. To spread such tolerance still further so that we can accept in good faith other people's opinions on social, economic and political questions, is one of the purposes behind the desire to gain a better scientific understanding of men.

X. Humanics and Education

All that is valuable in human society depends upon the opportunity for development accorded to the individual.

ALBERT EINSTEIN

HUMANICS TOUCHES EDUCATION at many points, in fact at *every* point. It should not only influence the method of teaching at different levels but should affect the content of instruction; it should be taken into account in connection not merely with the pupils who are to be taught but with the teachers who are responsible for instruction.

Many of the fruits of humanics which are in prospect, including those to be discussed in succeeding chapters, cannot be realized unless there is wide dissemination of scientific information about human beings and how they differ from one another. Even though our knowledge in the field of humanics should increase by leaps and bounds, its value and use, in the hands of experts alone, would be small compared with the potentialities that would exist if the general public were educated with respect to it.

In order to cultivate a tolerance for each other and an appreciation of each other's make-up it is essential that children have an early start—even in the preschool years—and this means that mothers and fathers and future mothers and fathers must be informed and appreciative as to the magnitude and importance of individual differences.

Extreme environmentalists who hold or have held that the story of education is simply one of conditioned reflexes, and that the

outcome of one's life depends wholly on training, are forced back into the very early years of a child's life in order to account for formative influences. While we cannot accept the extreme point of view we recognize that the very early years are of great importance, and that attitudes can arise at this time.

After people reach adult or middle life new facts and information, which might have had a profound effect if presented earlier, may readily become passive and inert information. Even though the facts may be accepted intellectually, attitudes and habits of thought are too well formed to be greatly affected. If we wish to develop more of an appreciation of the dignity and uniqueness of individual human beings, children must be reared in an atmosphere where the basic information which promotes this attitude is readily acquired.

Fortunately there is already, among adults who possess a generous portion of common sense, a considerable appreciation of the wide personality differences that exist. The prevalence of this idea is due no doubt in part to the study and emphasis that some psychologists have devoted to individual differences; however, this appreciation is also one of those things which is often learned in the process of living and not out of books or from teachers. Men of affairs who have learned how to deal with people appreciate—and some of them very keenly—that each individual is something of a rule unto himself. They make use of this knowledge daily.

When adults become informed there will be no serious obstacles to teaching even small children through demonstration and experiment that they and their school friends differ greatly among themselves in numerous ways—in their ability to detect various odors, in their liking for various odors, in their ability to discriminate pitch, in their sense of timing, their preferences with regard to musical selections, their taste in design, their ability to discriminate among colors, in the readiness with which they "see out of the corners of their eyes," in their sense of touch and their response to visual and auditory stimuli, in their liking and aptitudes for various games and skills, etc.

If children were given the opportunity to learn such information early it would start their habits of thought in the right direction. They would learn to be tolerant early. Instead of going through life on the assumption "If the other fellow feels or acts differently from me, he is 'putting on' or else a 'bit crazy,'" they will build up their ideas (or philosophy if you will) on the basis of the individuality and dignity of each human being. Instead of thinking of other people as belonging in categories such as smart, smarter, smartest or dull, duller, dullest, even children will be in position to become acquainted with people as they actually are—the possessors of various mental abilities and traits in varying degrees, superior in some, inferior in some, average in others.

Intelligent mothers and fathers early recognize differences between their children and often learn to deal with them individually in accordance with these differences. But science has contributed comparatively little to help them in this important phase of their parenthood, and children have never been made to appreciate how much they differ amongst themselves. Many important differences are overlooked and many of the adjustments in the family and in the school are made on the basis that what fits one child must fit others. This is comparable to passing out the same sized clothing indiscriminately to all members of the household.

2

Humanics could not be of greatest service to education if it neglected the teachers. They too are human beings and each has his or her individual aptitudes, interests and abilities.

It is, of course, extremely important for education that individuals with the highest aptitudes and abilities be attracted to the profession. Not only should the inducements with respect to standing, prestige and pay be adequate, but it is necessary to be able to recognize aptitude in potential teachers. How can this be done if

we do not know about their various traits and abilities? Or if we do not know what traits and abilities are desirable in teachers?

It is easy, however, to fall into the error of thinking of *the* teacher or *the ideal* teacher. Teachers cannot be reduced to statistics any more than pupils can; a teacher may be excellent for some pupils and poor for others. A teacher who has a strong tendency to be ear-minded may be expected to do well with students of similar tendency, provided the other necessary attributes are present, but such a teacher's effectiveness with students who are strongly visually minded will probably be low. This is merely one basis for classifying teachers and I do not imply that it is the most important one.

In my professional experience I feel sure that I have observed many cases where particular students and instructors conspicuously fit each other mentally and other cases where there were serious misfits. The misfits were not due to a lack of ability on the part of either teacher or student but were due to differences in abilities. I have at numerous times felt that in my own teaching I was doing an excellent job with some students, while for others it was mediocre at best.

We have mentioned the mental breach between the students and faculty who lean toward the humanities, on the one hand, and those who have an affinity for such subjects as chemistry and physics, on the other. When the natural scientist reads the writings of his non-scientist colleagues he is liable to exclaim, inwardly or outwardly—"Words! Words! Words!" The non-scientist on reading the contribution of his scientific colleagues may exclaim (for all I know)—"Symbols! Symbols! Symbols!" Whether this contrasting analysis is meaningful or not, the fact is clear that experts in science and experts in non-science may both have high abilities and still be far apart in their mental lives. Their abilities are not of the same type.

In every educational system there should be the possibility of shifting pupils from one teacher to another, in the event that mental or other incompatibilities exist. If we knew more about individuals

and more about the nature of the incompatibilities which are likely to be most bothersome, such adjustments could probably often be made before difficulties arise.

3

Our failure to pay more attention to individual children has been due in part to lack of information, but it also has its roots in the idea of carrying out education on a mass-production basis and attempting to reduce everything to statistics. Even those who react against too much emphasis on tests and statistics talk more about the abstract concept *the individual* than about individuals. Articles and books galore have been written dealing with all aspects of educating *the child* or even *the individual child,* but the importance of recognizing each child as an individual with widely different aptitudes has rarely been stressed. R. B. Cattell has said (presumably in an optimistic moment), "The modern educator realizes that progress must be based upon a scientific understanding of the emotional and mental make-up of each mind." [1] This, stated as an ideal, seems very far from realization. Many educators are more likely to take the view glibly expressed by a prominent leader who, writing on the general subject of the importance of the individual, says, "Every boy and girl at more or less frequent intervals demands attention as an individual." This is almost like saying, "Each cog in the machine is liable sometime or other to develop a crack or flaw." [2]

One of the functions of education is to help the student find his place in the world and we could start on this problem much earlier than we do. Students go all the way through college without learning what their aptitudes are or what they might be fitted for. I know of one who found out his aptitudes for the first time after college graduation, in an army examination. It probably would have been possible to gain exactly the same information when he was in grade school; then his college education would not have required repetition, as in this instance it did.

If the elementary teacher has a reasonably small class, she can begin to learn in the early grades about the individuality of each of her pupils. The concrete information about specific capacities (not a generalized I.Q.) which she has gained, as well as her estimates, can be passed on to the teacher of the next higher grade and if this gathering and revision of information is continued the capabilities of the students will be pretty well known by the time they have finished the grade school, and their futures can be mapped intelligently. We sometimes complain because students do not make up their minds until late what they want to do. We are certainly not doing what we should to help them.

When and if students arrive at the point where they see their way with reasonable clarity and are seriously considering, say, one of three professions—law, medicine, or engineering—they can take special examinations to test their aptitudes in any one of these fields.[3] This is a step in the right direction and the tests will no doubt be improved and increase in dependability with use and experience. But the student's aptitudes could be determined earlier with at least two important advantages—there would not be the shock to those who fail in the examinations and must violently change their plans, and secondly the respective professions would not be so likely to lose potentially valuable members simply because of their inability to know their aptitudes far enough ahead for effective planning.

The three professions for which aptitude tests have been developed constitute a very small percentage of the whole population and most people go into their life work with very inadequate information as to their prospects of success or alternative lines of work which might well have been chosen.

Knowing the aptitudes of the students early in their lives may cause them to gravitate in appropriate directions so far as choice of life work is concerned. However, this knowledge is only one part of the story. In order to know who should be a merchant, physician, factory worker, banker, mechanic, lawyer, writer, clerk, stenographer, teacher, artist, scientist, statesman or engineer we need to know *what traits make for success in these particular fields.*

An experimental approach to this problem involves studying individually successful men and women to find out what traits are present and which ones may be absent. Some are obvious, but others are not, especially when we consider that there are many kinds of physicians, mechanics, writers, scientists, and so on. If we knew with a fair degree of certainty what traits are indispensable for success in various lines of endeavor, and if we knew also the traits possessed by an individual student, then vocational guidance could be intelligent. Most often a person chooses a type of work with very little advance knowledge of what is in prospect. Verbal descriptions concocted by someone else are liable to be painfully inadequate.

Because children may inherit and develop traits which differ very much from those of their parents, the parents themselves, unless they are highly alert to individual differences, are not necessarily good advisors. Benjamin Franklin, Charles Darwin and George Bellows, the artist, were groomed by their parents to become ministers. Cellini was intended, according to his parents' advice, to become a musician instead of a goldsmith and artist. Debussy's father, on the other hand, aspired to make a naval officer out of him instead of a composer. Gallileo and Leopold Damrosch were cut out for medicine, according to their parents' notions, and the legal profession was chosen by the parents of Dumas and Balzac for their sons' careers. Anyone familiar with the lives and personalities of the two Oliver Wendell Holmes, senior and junior, will appreciate how poorly the son's tastes could be judged on the basis of the tastes of the father.

4

There is abundant historical evidence to show that neglect of individuality has resulted in the past in the failure of schools to perform their function.

A classical example is that of Thomas Edison whose teacher said he was addled and was not worth keeping in school any more. Edison admits his deficiency: "I remember I used never to be able

to get along at school. I don't know now what it was, but I was always at the foot of the class." It seems safe from all we know about Edison that his difficulty was not lack of ability; it was the lack of the abilities required to do the work prescribed in the particular school by the particular teacher. His mother, who had been a schoolteacher, was convinced that her son, instead of being a dullard, had outstanding ability, and she defended him in no uncertain terms. It is fortunate that Edison had a mother who could help him. He said, "She never misunderstood or misjudged me," and he thrived under the individual instruction which she gave him. She was evidently a woman of unusual insight and independence of thought. Edison said of her, "She believed that many of the boys who turned out badly by the time they grew to manhood, would have been valuable citizens if they had been handled right when they were young. Her years of experience as a schoolteacher taught her many things about human nature, and especially about boys."[4] *

It is evident that in Edison's case the school failed to recognize his individual traits, and therefore failed to do its duty by him.

Sometimes there is a misapprehension about Abraham Lincoln's school experiences. We sometimes think, "Poor boy, he didn't have an opportunity for schooling." Actually, however, there is reason to think that he had more opportunities than he cared to avail himself of. He went to school a total of about a year, "by littles" as he said. He left few biographical notes regarding his childhood but he did indicate "There were some schools, so-called— There was absolutely nothing to excite ambition for education." Reading between the lines, it seems probable that Lincoln's school experiences were rather sad and that after he had learned the rudiments of reading he found self-directed reading to be more profitable than school attendance.[5] Again, the schools failed to recognize individual gifts and consequently failed to perform their function. By himself, with the loan of books he was able to give himself a highly

* From *Thomas Alva Edison,* by Dr. Francis T. Miller, copyright 1940, reprinted by permission of The John C. Winston Company.

effective and distinctive education, suited to his own remarkable abilities.

The scholastic education of Benjamin Franklin was also largely a failure. Van Doren, his biographer, says, "But he was almost wholly self-taught as if he had never gone to school." Here was another individual with remarkable abilities, but they were not the kind of abilities that made him take to Latin or arithmetic, and hence the school failed to contribute materially to his education.[6]

It is interesting that these three Americans, recognized as among the greatest, should all have had highly individualized educations obtained largely by reading books of their own choice. Even a single great book is not the same when read by different individuals: variable attention, interests and backgrounds cause the same book to appeal in different ways and to carry different meanings and points of emphasis.

While of these three Edison might be classed by some as an eccentric genius, no one would call the endowments of the other two bizarre and there is no reason they should not have been served well by schools that served other children. But to say this is to assume that what is good for one child is good for another—an entirely false assumption. Actually all three personalities were sufficiently different so that scholastic education built on the dictum "treat 'em all alike" failed almost completely.

Of course one may answer that the earlier schools were all poor. Possibly true, but on the other hand, there are plenty of historical examples of men who during the same periods excelled in school work and derived great benefit from it. Generally the work and methods of a particular school were approximately suited to some of the pupils; otherwise the schools could hardly have continued their existence.

It is obvious that if Franklin, Lincoln and Edison were youngsters in this day and age, they would attend school much more than they did (averaging as they did between one and two years). But can we be sure that today they would receive the individualized education they needed? Is it possible that they would be run

through the mill, and as a result turned out to be more like run-of-the-mill people? Certainly many of their ideas and attitudes were not the sort that would naturally blossom out of a schoolroom but were more likely to arise as a result of diversified reading and reflective thought.

There is doubtless a greater possibility of having scholastic misfits when the pupil has unusually keen aptitudes along technical and mathematical lines. Einstein was seemingly slow and backward in elementary school and we may guess that what was required of him was outside his range of aptitudes. He did not look back on elementary school with any pleasure and likened his teachers to non-commissioned officers. Henry Ford made little use of scholastic education, but trained himself effectively for his future work. Available education did not suit his purpose and no one in his day thought of giving him a mechanical aptitude test, in which doubtless he would have rated very high.

Even people who are inclined toward literature have not always been enthusiastic about their formal education. James Whitcomb Riley said, "Omit the schoolroom from my history entirely, and the record of my career would not be seriously affected." Chesterton characterized his schooling as "being taught by people I didn't know, things that I didn't want to know." On the other hand people who are far from academically minded may fit into a particular schoolroom excellently. Andrew Carnegie, for example, though his schooling was very limited, while it lasted stood at the top of his class and had the reputation of being the teacher's pet. He attributed most of his education, however, to the books he read, and this was the cause of his establishing thousands of public libraries.

In elementary schools where students ordinarily have the same teacher for all or nearly all of the subjects, a very great deal depends on teacher-student relationships. If the student and teacher are entirely different in temperament, traits, and mental abilities, and if the method of doing things is prescribed by some outsider, it is

too much to expect that the pupil will enjoy and profit by his school work. We shouldn't expect the impossible.

Three of our greatest men succeeded in life largely in spite of their schooling. How many have there been who have failed in life *because of their schooling?* It is by no means safe to say that men of ability will always triumph over the obstacles that are in their path. There have been plenty of failures among able people—not only failures in the sense of failing to achieve their full potentialities, but even more striking failures in that they have become criminals and drags upon society. Dostoevsky once said of criminals, "Perhaps they are the most gifted, the strongest, of our people."

Studies have indeed indicated that while there are in convict populations more than a proportional number of so-called feeble-minded, the general average of intelligence of penitentiary inmates (based on intelligence quotients) may be distinctly higher than that of the general population.[7] The larger number of criminals who remain out of prison are certainly not less able intellectually than those who are in prison. If intelligence quotients could be devised so as to be *complete* measures of mental ability, instead of being so largely a measure of ability to do traditional school work, then on this basis the criminals would probably outshine the general population even more. Criminals as well as other failures frequently are, according to my thesis, persons whose individuality and distinctive traits and abilities have never been taken account of or in many cases even recognized. In the case of active criminals, they have found unsocial outlets for their energies and abilities.

It is well known that having an occupation for which one is fitted is the best possible insurance against criminality. When schools fail to recognize distinctive abilities and traits, and fail to help youngsters find suitable vocations, they turn loose upon society various types of misfits. It is from these misfits that our criminals develop.

5

To educate parents, teachers and prospective parents and teachers, in the fundamental scientific facts regarding the prevalence and importance of individual differences, is obviously one of the first tasks of humanics.

To do this adequately and at once is impossible but we can make progress. Clearly it will require zeal and co-operation on the part of people with many different interests, but we hope to show in the succeeding chapters that progress in this direction is of vital importance to all. Since it concerns us all so intimately, there is prospect of our joining in a common purpose in the same way that we do when a war threatens our safety and freedom.

We have attempted to emphasize that the facts of humanics are by no means all known, and that much research and study will be essential for bringing it to full fruition. One of the important functions of institutions of higher education is to extend the boundaries of knowledge, and humanics will enter into this function to an important extent. Curious minds are alert minds and teachers, possibly above all others, should have them. This is the fundamental reason why research and advanced teaching are inexorably associated. Curious, alert persons, who should be the teachers, are not the kind who can contentedly plod along unmindful of the potential discoveries that lie all around them.

If the ideas that are set forth in this chapter are translated into action it will require greatly added support for education. But it will be an investment for which we can hope to reap benefits, financial and otherwise, far beyond the amount invested. If we could save a substantial part of our crime bill, for which there is excellent prospect, it alone would more than pay the expense for greatly increased and greatly improved school facilities.

It would be presumptuous on my part to attempt to outline just what schools need. It seems obvious, from the standpoint of our

discussion, that some of the measures adopted in so-called progressive schools are highly desirable and that more education having to do with trades and vocations will be essential. From the standpoint of individual attention the most crucial and most expensive need is for more and better teachers, so that classes can be smaller and teaching more effective.

Nietzsche probably had size of classes in mind when he said, "In large states public education will always be mediocre, for the same reason that in large kitchens the cooking is usually bad." Actually cooking in large kitchens doesn't have to be bad; that is, if there are enough capable cooks. Schools can serve us effectively only if they abandon wholesale methods and pay attention to the individual pupils.

One of the important possibilities in connection with school organization is that of segregating students into homogeneous groups within which individual differences will not be large. It is reported that in the Detroit public schools all children are given psychological tests in the first grade and are thereby classified as belonging to the middle group (about 60 per cent), upper group (about 20 per cent), or lower group (about 20 per cent). In addition, those with definite handicaps constitute another of approximately 2 per cent. Special courses are organized for the different groups.[8]

The idea of classifying students and caring for them in groups is an excellent one, but if the fundamental thesis of this book is sound, children should be classified on the basis of their special mental capacities and not on the unscientific basis of supposed intelligence quotients. To deal with children as though they belong necessarily to one of the groups (1) handicapped, (2) dull, (3) mediocre, (4) bright, is to do violence to the scientific facts and to undermine morale and healthful attitudes.

One of the tasks of large-scale education in the future will be developing suitable groupings so that children with similar aptitudes can be taken care of in accordance with their needs, and will not be forced to wear average sized shoes that do not fit.

XI. Marriage

When a man meets his fitting mate,
society begins.

R. W. EMERSON

IN THEIR VALUABLE BOOK on success and failure in marriage, Burgess and Cottrell stress the general point of view which we have adopted. They say in their preface:

In modern society, knowledge is becoming indispensable in every phase of human living. The increasing knowledge of physical nature made possible the great inventions which are changing our institutions and our mode of living. Medical knowledge has removed or reduced the scourges of communicable and other diseases. Increase in our information about human nature and social relations is likewise essential for dealing with many of the problems of human adjustment.

Of the marriage problem they say:

In few fields of human relations is the need for knowledge more evident, the demand for it more insistent, and the amount of verifiable information so scanty and fragmentary, as in the field of marriage adjustment.[1] *

Marriage is indeed one of the concrete problems to which humanics can make a direct and immediate contribution. I say the *marriage* problem rather than that of *marriage and divorce,* because if we take care of the marriages, the divorces will take care of themselves. Divorces involve the severance of marital relations: the

* From *Predicting Success or Failure in Marriage,* by F. W. Burgess and L. S. Cottrell, copyright 1939, reprinted by permission of Prentice-Hall, Inc.

most extreme measure taken to end an unhappy state of affairs. People differ in their attitudes toward divorce; some simply take the position that if you come to dislike one mate you should choose another; others think of divorce as only to be considered when the marriage becomes unbearable; still others go to the extreme of discountenancing all divorces.

Whatever one's opinion may be with respect to the ease with which divorces should be obtained (I do not expect to discuss this question), all will agree upon the desirability of fostering the kind of marriages in which the question of the ease of divorce never becomes involved. In a sense, abolishing divorce would solve the divorce problem, but it would not solve the marriage problem. There would still be the violent consequences of serious misfits. The obvious desire of society as a whole, regardless of the diverse attitudes of individuals toward divorce, is to promote happy and wholesome marriages.

This may mean locking the stable door before the horse is stolen. If society could bar the way toward unhappy and unwholesome marriages, and could smooth the way toward those that involve no regrets, then vastly more than the divorce problem would be solved. Instead, society has in general made marriage scandalously easy and haphazard and has thereby saddled itself with the problem of what to do about the unhappy marriages that have resulted.

On what basis can we hope to promote happy and lasting marriages? The obvious answer is: marriage involves adjustments to individuals, and knowledge about the individuals is prerequisite to dealing with them successfully. There is no place in our society where the need for humanics is more apparent. Marriage is a highly personal and individual matter; it is never a question of a man adapting to an *average* woman, or of a woman being happy with an *average* man. Each marriage relationship involves the mutual accommodation between a specific, distinctive individual man and a woman who has traits and abilities that no one else possesses.

2

The first and immediate contribution that humanics can make to the marriage problem is to promote tolerance and understanding between husbands and wives by bringing to the fore certain facts of life with regard to how widely and in what diverse ways we may differ one from another psychologically and physiologically. If each spouse could even partially appreciate the fundamental background of the other—the why of his or her behavior—then many of the frictions could be eliminated. This presupposes, of course, an ability to change viewpoints, which generally becomes more difficult as we get older. There are many little causes of friction that have a readily discernible physiological basis and when these are understood and appreciated the irritation tends to disappear.

If we can give children the education in humanics which they need, then the problem of marriage will move toward solution more rapidly. If children learn early to appreciate the significance of individuality and the way individuals are made up, it will become second nature for them to respect the opinions and wishes of others, and to accord that dignity and deference to their spouses that will make toward happy marriages regardless of how the individuals are mated. Differences in traits which potentially can cause serious trouble become much less troublesome *when they are recognized.* If, for some physiological reason, a husband likes one thing or one way of doing something, and the wife does not, they can remain happy in spite of the differences, provided their education has developed tolerance and an appreciation of the underlying reasons.

If education devotes attention to individual differences there will be an inevitable tendency for children in general to know each other better, and this will naturally give a much improved basis for choosing a mate in later years.

3

A more important contribution which humanics can make is in discovering the basic reasons for success in marriage, and in predicting the outcome of proposed marriages on the basis of scientific study of the individuals. The time should arrive in the not too distant future when a couple contemplating marriage can be advised with a high degree of accuracy as to their prospects of a successful union.

As a basis for judgment, not only will it be desirable to have information about their family life and personal adjustments, their sex education, their attitude toward marriage, toward religion, and many other such items which can be obtained with considerable success by questionnaire methods, but in addition objective information about their physiological and psychological traits will be essential.

Remarkably fine work is being done in several marriage clinics, institutes of family relations, and so forth, in various cities of the country, in the way of giving advice and aid to married couples and those contemplating marriage. There is also interest and valuable activity in this field in various universities and colleges. Some psychological background and a large measure of common sense (the importance of which in this connection can hardly be exaggerated) has made possible a high degree of success in giving advice. Some newspaper columnists do a valuable service in their wholesome attention to personal problems related to marriage.[2]

As Burgess and Cottrell intimate, however, whatever is done in the way of bringing about adjustments is accomplished in the absence of anything more than scanty and fragmentary scientific information. We can at present only dream about what could be accomplished if scientific information were abundant. Every kind of insight is worth attention, but certainly no type of information

holds as much promise as a study of individuals with respect to their physiological and psychological traits and backgrounds.

An experimental approach involves the study of couples who have been successful in marriage and of others who have not, to determine which traits are important and which are comparatively unimportant. This method has been used with relative success in studies involving questionnaires, but of course the type of information that can be obtained in this way is limited.

Some studies have used divorce as a criterion of failure in marriage and absence of divorce as an indication of success. This is a crude criterion because people differ greatly in their attitude toward divorce. Furthermore, there are all degrees of success in marriage. Even among the marriages which are regarded as successful (because no divorce results) there are countless numbers in which the relationships could be subject to great improvement. An application of humanics to the problem may, and should, raise greatly our idea of what constitutes success in marriage.

4

According to the quotation from Weiman given earlier, "Perhaps more lives are ruined through inability to deal with little everyday common things than for any other reason." While the discussions on marriage do not seem to stress the fact, I believe that the importance of seeming trivialities in marriage relationships is generally recognized. Distressing differences and rows can start over things which appear to the disinterested outsider as inconsequential in the extreme.

The wife may start the ball rolling by neglecting, when her husband is in a hurry to catch a bus or train in the morning, to have his coffee hot enough for him to enjoy. Now this is seemingly a trifling thing but can nevertheless lead to serious psychological upsets. It is interesting that it can have a definite physiological basis understandable only as a result of studying individual differences.

People differ widely in their temperature adaptations, and the tissues inside the mouth are not exempt from such variations. Some like coffee piping hot and dislike it when it is cooler. Others, on the other hand, cannot stand it to take hot coffee or soup into their mouths. I had a young lady confess to me that she never likes a hot drink, and was positive that she had made the mistake of serving guests with soup and coffee that was cooler than they liked, because of her own preference.

An elementary education in the nature and prevalence of individual differences on the part of the husband and wife would probably prevent the friction. She would be aware of her husband's differences and would know about his liking for hot coffee. He, on the other hand, would recognize that she might have differences too, and would not be so quick to jump to erroneous conclusions.

A thousand situations comparable to this might arise involving little things—bed coverings, open windows, choice of perfume, fluorescent lamps, the color of neckties, late sleeping or early rising, noisiness, food preparation, a liking for reading in bed or the dislike, time of meals, and so on through the whole day. Each situation may have a definite physiological basis and understanding would tend in one way or another to eliminate the irritation.

It is likely that the effect of these little differences is cumulative, and that couples who show too many contrasting traits of this sort should be discouraged from marrying. Imagine for example two persons, A and B, with the following traits or tastes:

	A	*B*
1.	Dislikes checkers and chess.	Likes checkers and chess (spatial imagery).
2.	Likes athletic sports.	Doesn't care for sports.
3.	Derives great pleasure from eating.	Is generally indifferent to food.
4.	Likes to read.	Doesn't care to read much (eyestrain).

5.	Likes room "plenty warm."	Likes cool temperatures.
6.	Is sensitive to noise.	Has a tendency to be noisy.
7.	Likes subdued light.	Likes bright illumination.
8.	Needs meals on time.	Doesn't care.
9.	Enjoys and appreciates design.	Is indifferent to design.
10.	Likes plenty of bed covering.	Sleeps lightly covered.
11.	Cares only for rhythm in music.	Is sensitive to harmony.
12.	Likes to sit near the back in movie theaters.	Likes to sit near the front.
13.	Doesn't mind stuffy rooms.	Is sensitive to stale odors.
14.	Is indifferent to colors.	Is sensitive to colors (sunsets, etc.)

I think that we would be safe in giving such a couple the offhand advice (especially if they were uncertain enough to ask it), not to marry. Their ideals and attitudes and other adjustments might be perfect but with all these conflicting traits to deal with they certainly would have an uphill battle. To have knowledge of each other's traits and appreciate their physiological basis would help, but the situation in the end might be like the man who is purported to have said, "Yes, I've been married to her for fifteen years —and I still don't like her."

Couples with so many opposing traits would in actual life never want to marry *if they were acquainted with each other.* Being acquainted and "keeping company" is unquestionably important for this very reason. The study of Burgess and Cottrell, referred to above, showed clearly that couples with no more than six months' acquaintance had statistically a much poorer chance of success in marriage than those with acquaintance up to two years. The couples who knew each other for two years, on the other hand, had distinctly less of a chance than those who had known each other a longer time. An important function of a long courtship is for the couple to get familiar with these little traits (as well as others to be

discussed later) and know each other's tastes. Attendance at movies might, if they were frank with each other, clear up item 12 above. Being together in homes might bring adjustment on such items as 3, 4, 5, 7, 8, and 13. Seeing each other under varying conditions time and again would ultimately make them acquainted so far as the majority of the listed items go.

If desired, this process of getting acquainted could probably be greatly speeded up by a frank comparison and appraisal of tastes and traits of the type considered, or at least by paying attention to this type of difference. Especially would a consideration of trait differences be important if a study of these traits were a common procedure and if we had scientific knowledge of which of the various physiological traits are of greatest consequence in marriage.

5

The psychological traits of individuals who are parties to a marriage contract are not discussed along with the "little things" because they seem to be more important. They are, however, admittedly difficult to delineate and to measure. Not infrequently they are variable from time to time in the same individual.

While the classification and characterization of various mental abilities may be far from final in the scientific sense, a number of them can be measured with considerable reliability. Couples who contemplate matrimony should not necessarily have mental abilities that match each other, item for item. If one member of the partnership should have poor rote-memory abilities, for example, it would be very convenient for the other member to rate high in this respect because there are many items in connection with family life that someone needs to remember. Likewise if one member is a poor speller (word recognition) it is convenient if the other is a good one.

It would seem highly desirable that any party to a prospective marriage should know about the mental abilities of his or her pro-

spective mate, because adaptations can best be made on the basis of knowledge. If the results of specific tests were available and were interpreted not too literally they would be valuable. Traditional I.Q. scores would, on the other hand, probably do more harm than good. If a husband's score is 120 and his wife's 100, it would be natural for him to draw the conclusion that he is smarter in every way. The chances that her abilities surpass his *in some respects,* however, are excellent. A knowledge of each other's specific abilities would promote a real partnership, in which some matters would be better handled by the wife and others by the husband. Such divisions commonly occur in well-adjusted families but it may take a lot of experimentation to arrive at a happy solution.

The fact that certain minds work together well—click, in the colloquial sense—seems to me to be very important, and one of the functions of courtship and keeping company is that the two individuals may try out each other's minds. I have been forcefully impressed many times with the fact that when some individuals talk or write they talk my language; what they say makes perfect sense. On the other hand, others may approach matters in a strange manner, make assumptions that I would not make, become interested in aspects that would not interest me, and the whole discussion became practically worthless *for me.* This does not mean that it is worthless for other people.

Such mental leanings, mental attractions and repulsions, are important in marriage relations and I see no way in which they can be recognized as readily as they can by conversations on all sorts of topics. The attitude of people toward poetry may serve as an example. Some people have no use for poetry in any form. If all the poetry books in the world were burned they wouldn't be directly affected. While one who has no use for poetry is unfortunate in that respect, it does not mean that he is depraved, lacking in the finer things of life, or boorish. It means that he doesn't have the mental abilities and traits to which poetry appeals. Another may have a mental make-up for which poetry has a gripping appeal; he is sensitive to its niceties and can recognize it whether it is labeled poetry

or not. Is such an individual a superior being? Only in this one attribute. In other respects he may be quite inferior and in some he is likely to be deficient.

Psychological traits other than those directly associated with mental abilities are often important. Just how the traits of males and females complement each other is not well understood but highly masculine men are attracted by the feminine traits of women and vice versa. More definite knowledge about the distinctive traits of males and females is desirable.

Among the traits, often unrecognized and unnamed, which enter into marital relationships in an important way, are introversion and extroversion, altruism and egoism, expansiveness and reclusiveness, dominance and submission, orderliness and its opposite. Some of these are doubtless of greater importance in matrimony than others but definite knowledge on this is lacking.

Clearly the marriage relationship is a complementary one, and not the union of two individuals each of whom is self-sufficient. Members of the partnership should not have exactly the same assortment of traits. Particularly is this notable in regard to dominance. If both are markedly of the dominant type there is sure to be trouble ahead, unless one or the other can assume a submissive role. In such cases, again, division of interests is a desirable outcome. The husband can be dominant in certain matters in which he is more competent and the wife can take the lead in those in which her abilities are superior.

The only way we can learn how important these various traits are, is to study intensively the traits and adjustments of specific married couples. Just as the searchlight of science has never been fully directed toward any specific human being, no particular marriage has been studied fully. Many case studies have been made, it is true, but never have the contracting parties been studied in detail from the standpoint of psychological traits, including mental abilities, and physiological traits. It would have been most interesting if such a remarkably well-adjusted marriage as has been described so convincingly by Cornelia Stratton Parker in her book *An*

American Idyll could have been studied scientifically before the husband's death. While the members of this partnership were doubtless unusually delightful people, it seems probable that their highly successful marriage was due not to their excessive virtues but more particularly to the fact that their various traits fit together to an extraordinary degree.

6

We have left until the last the most important factors in marriage, those which are at the basis of the whole institution, namely love and sex. Reik though for more than thirty years a follower of Freud, has made a strong case for recognizing love as something that does not have its origin in sex. He rebels most vigorously against the idea that love and sex are the same, and asserts that Freud in his later years modified his view materially, though he never fully retracted his earlier doctrine. Reik says, "Sex and love are so different that they belong to distinct realms of research fields; sex to the domain of biochemistry and physiology, love to the domain of the psychology of emotions." [3]

While I am inclined to accept Reik's point of view on the basis of present evidence, it seems highly profitable to study the sex characteristics of individuals far more fully than has ever been done, not only to develop a better understanding of sex but also because of the light which may be shed on the subject of love. It is perhaps in the field of sex that humanics can make its greatest immediate contribution.

If all male individuals had about the same love-making and sex propensities, and if all female individuals were alike in their reactions, the problem of marriage would be vastly simpler than it is. The sex question would not have to enter, and marriage adjustments would rest upon the other physiological and psychological traits of the individuals involved. But probably there is no feature in human personality and make-up where greater individuality and wider differences in attitude exist than in sex in its various aspects.

This is due to the fact that there are not only the two sexes but various phases and gradations between. Furthermore differences in sexual propensities are based not only on hereditary differences but also upon superimposed environmental influences, which may be very far-reaching.

We cannot take space to discuss every phase of the problem of sex, but must limit ourselves to material which will be illustrative of the need for individual study. There are several phases of sex activities which are at least partially separable.

First we may mention the romantic attraction which two children of opposite sexes may have for each other. While this doubtless has sex as a basis, the sex feature may be well submerged, and the adolescents or younger children involved may be wholly unconscious of its importance. In this phase of sex there are wide differences. Some children are continually falling in and out of love, others remain indifferent to what may be regarded as puppy love throughout life. Others remain indifferent for a time, but apparently reach a threshold and fall harder than usual. These differences doubtless have physiological and psychological meanings, if we but knew what they were.

This phase of romantic love need not terminate with marriage; in fact in the best adjusted marriages it continues on and on—not intensified perhaps, but deepened as the home develops and the interests of the marriage partners become more closely knit together.

Another phase involves overt and recognized sex urge, which in the male is most often readily and easily evoked, but which in the female is often aroused less readily and less rapidly. There is abundant reason for thinking that sex urges differ tremendously from individual to individual, but there is no ready way of measurement and we must depend upon inference. Sexual contact and satisfaction do not arrive in the same fashion for different individuals. While males by comparison are usually "quick on the trigger" they are by no means uniformly so, and females are variable in the speed with which they react. One of the common causes of

lack of sexual adjustment in marriage is the failure of the husband to recognize the difference between his wife and himself.

A factor which is of great importance in marriage relations and on which there is some more definite information is the speed of recurrence of the sex urge after its satisfaction. Some information about males is available and it is apparent that when contraceptives are used, and men are living with their wives under conditions such that the only limitations on sexual indulgence are physiological ones, there is an extreme variation in behavior. It is well known that the frequency with which the sex urge is developed diminishes with age, but here the variability is extreme. Apparently well-authenticated medical cases have been reported in which, on the one hand, a man in his thirties suffered exhaustion for several days as a result of sexual indulgence, and at the other extreme, a man past seventy consulted his doctor in fear of impotence because of his inability to perform the sexual act more than twice daily. Some of my readers will react to such cases with the remark that such men are abnormal. True, but the term abnormal often becomes rather meaningless. Society is made up mostly of abnormal people; each of us may be regarded as abnormal in one respect or another.

The enormous variability and the numerous factors involved make it rather surprising that so many marriage adjustments work out as well as they do.

What can humanics do to help in solving this problem of sex adjustments in marriage? Education as to natural variability will help, because recognition of differences and their physiological bases tends to make members of the partnership more tolerant. On the other hand a serious study of individuals from the standpoint of their sexual traits and their whole physiological and psychological make-up should make it possible to know in advance of marriage what the sexual propensities of a man or of a woman might be like. Extreme cases at least should be recognizable.

It has not been the custom in science to study any one individual thoroughly. Surely if the two individuals mentioned above—one in

his thirties, the other in his seventies—were compared thoroughly anatomically, physiologically and psychologically (including, of course, their hormone excretions) there would be found a clue somewhere to the striking difference in their sex traits. It is preposterous to think that this trait difference stands alone and unique without any connection with the anatomy, physiology, or psychology of the individuals. Such studies should lead to the discovery of tests, very likely of a physiological nature, whereby the sex drives and sex traits of individuals could be determined before marriage. In this way those whose sex traits are in strong contrast might know it in advance, and avoid marriage. If the tests were highly successful and dependable, they might constitute an important basis for giving advice to prospective marriage partners.

The importance of sex adjustment in marriage is unquestioned. Though there are reports of a fair number of cases where satisfactory adjustment to marriage resulted in spite of inadequate sexual response, it is probable that no marriage could be regarded as successful in anything approaching the ideal sense unless the sex adjustment was reasonably good. Obviously many marriages have been successful, in the sense that divorce has been avoided, without sex adjustment having existed.[4]

A highly important factor in marriage and its success, the bearing of children, is biologically the fundamental reason for marriage, and no marriage reaches the ideal unless healthy children are born and reared. Of course no marriage could be considered unsuccessful in the broad sense if it leads to a life-long happy companionship. Childlessness is nevertheless one of the causes of unsuccessful marriage and consequently for divorce.

Among the numerous ways in which individuals show great variation is in their *degree* of fertility. If two individuals mate, both of whom possess a high degree of fertility, pregnancy will result. If both possess a low degree of fertility they may remain childless indefinitely. Many such cases have been recorded, in which subsequently both partners to a childless marriage were found capable

of parenthood. Some reports have indicated that the inability of some couples to have children is due to a type of physiological antagonism, whereby normal fertilization is prevented.

Various bodily conditions—vitamin deficiencies, endocrine disorders and emotional states—may be responsible for alteration of the degree of fertility of the same individual at different times.

A thorough study of individuals from numerous physiological angles may easily result in the discovery of methods whereby the childlessness of prospective marriage partners could be predicted. The failure of a couple to beget children need not, of course, be calamitous. The success of their marriage may rest upon a devoted companionship. On the other hand, artificial insemination can be resorted to, as well as the common expedient of adopting children.

In summary we may say that the fruits of happy, well-adjusted marriages are among the most important boons of civilization or of life. Insofar as the marriage problem can be solved, the problem of the home and the rearing of children can be solved, and unless progress and improvement can come here it can come nowhere.

XII. Criminology

We might classify individuals into categories, but, in the last analysis, every individual who commits a crime is in a class by himself.

BARNES AND TEETERS

THERE ARE THREE IMPORTANT ASPECTS of criminology to which humanics can make significant contributions, namely, in: (1) prevention of criminality, (2) apprehension of criminals, and (3) effective treatment of criminals.

The whole problem of crime is vast in its scope, intricate in its pattern and overwhelming in its importance. Its cost directly and indirectly is enormous; many billions of dollars annually in money, in addition to the destroyed, ruined and damaged lives. Humanics if taken seriously, can tremendously alleviate the crime problem, can save enormous sums of money and pay large dividends in human values. We shall discuss briefly some of its potentialities.

2

In order to prevent criminality, it is first essential that we understand criminals and how they get that way; then perhaps we can strike at the root of the trouble. Understanding a criminal is a complex undertaking, just like understanding any other human being, and we cannot hope to succeed without intensive scientific study.

In the field of criminology there is already a strong tendency to

recognize individuality and not to rely upon half-baked or superficial classifications. Barnes and Teeters say, "Each individual is a peculiar entity unto himself and must be studied as such. Roughly speaking, for rough it is, we might classify individuals into categories, but, in the last analysis, every individual who commits a crime is in a class by himself."[1]

On the basis of an enormous amount of study of crime and the compiling of thousands of case histories, we have already considerable comprehension of the causes of crime, though the information is not as definite as it might be if we were in the habit of making more thorough scientific studies of individuals.

Heredity is undoubtedly a factor in crime, but it would be entirely erroneous and out of accord with the facts to think that criminality is inherited in any simple way, for instance by being a unit character that is passed down from father to son. Criminals are like other people; they inherit complex assortments of traits and drives, physiological and psychological in nature, and the particular assortment which one possesses comes into play along with environmental influences to mold the individual's life. A particular set of traits may be highly unfavorable for the environment in which the possessor is placed, and hence may lead to criminality. There are examples, of course, of criminals with very unbalanced traits, certain types of feeble-mindedness, sex perversions and criminal insanity. In these cases we may with some justification place our finger upon hereditary traits as the cause of the criminality. Sterilization and eugenic measures are then in order.

By and large, however, criminals are, according to the best evidence, complex mixtures and fundamentally not so different from the rest of us. We have already indicated that criminals may, on the basis of intelligence tests, rate even higher than the general population, especially so if we include among the criminals those who are skillful in avoiding apprehension and hence are not included in the prison populations. So far as drive is concerned, criminals as a group are probably not lacking; in fact, it may well be that their difficulties often center in their drives being too strong.

With regard to moral ideas, Lewis E. Lawes, long time warden of Sing Sing, says, "Prisoners do not have to be taught moral precepts; unless they are insane or feeble-minded, they know the difference between right and wrong."

If a person has ability, drive and sense of moral value, how can criminality develop in him? It seems to me that an important answer lies in the fact that each member of the human family has his distinctive collection of traits but that *probably in the case of the great majority of criminals, their individualities have never been recognized or taken account of,* and society has never helped them find a place where they, with their distinctive traits, can serve with self-respect.

A strong basic urge in all of us is to covet recognition and standing. When a child with superior equipment is sent to a school in which his aptitudes are not recognized, his desire for approbation is thwarted. Since he has the drive and the intelligence (possibly consisting of an unusual set of mental abilities) and cannot obtain the approval that he needs from the school or from the home, he may seek to attract notice and make an impression on his fellows by being a "tough guy." Unless there are fortunate influences which change the course of his conduct he is then headed toward a career in crime.

Thomas Edison when he left his meager schooling was probably an excellent example of a potential criminal. But there was an insurmountable obstacle which stood in the way—his mother. She believed in him, defended him, brought out his abilities and gave him the very type of self-respect that everyone needs. She was apparently somewhat aware of the role she was playing. She realized that boys who were not handled right were liable to be in trouble in later life.

Criminals are evidently turned out with great regularity by society as it is now organized. They usually begin to develop criminal tendencies in early adolescence and begin to be arrested for various offenses in larger numbers as they grow older. For several years the age of maximum criminal arrests in this country was

nineteen. The statistics of the ages at which arrests are made are complicated by the fact that jurisdiction usually changes from the juvenile to other courts at sixteen but there is evidence that the number of offenders increases steadily year by year until the peak is reached.

Youngsters who are on the way to being criminals usually begin by committing offenses for which they are not arrested, and the date of their first arrest is not by any means the date at which their criminal career began. Often they may exercise caution and avoid arrest; if they are skillful and forethoughtful enough or receive instruction from experienced criminals they may avoid arrest indefinitely. Sooner or later they then become professional criminals and associated with organized crime.

The weak point in the life of youth, taken as a group, comes in the gap which exists between the last of their schooling and the time when they settle down (if they do) to a job. If their school work has not been such as to give them encouragement and status and if it has failed to prepare them for anything in particular; if on top of this their home life is such as to make them feel alone in the world, without friends who believe in them, then criminality has fertile soil in which to grow. Schoolwork has often had a demoralizing effect on children of ability who have not fitted into the pattern—and seldom is the fit an entirely satisfactory one.

A boy in such a situation doesn't have to be a degenerate or lacking in worth-while qualities to take the first steps toward a criminal career. Every boy who has visited a watermelon patch at night, or who has swiped apples or peaches from a neighbor's tree, has in him the makings of a criminal. All that is required is development.

As a matter of fact there is a taint of criminality in many of us who are thoroughly respectable and law-abiding citizens. What about the office boy who according to tradition steals time for a ball game in the pretense of attending his grandmother's funeral? Or the plumber who traditionally counts his time while he goes back for his tools? What about the people who often avoid giving honest service, by getting to work late, leaving early and what not?

What about the person who takes and holds a job and receives a salary for it, when he knows he isn't needed, and that his services are largely or wholly superfluous? What about the salesmen who traditionally pad their expense accounts? How about the sharp businessman who finds legal ways of getting what doesn't belong to him? How about the government official, responsible for public funds, who lets them be wasted extravagantly because it is not his money that is being wasted? How about the public official who fails to vote in the interest of public good, because it conflicts with his own interest? How about the laborer who supports his union in enforcing restrictions which prevent him and his fellows from giving honest service? Or the taxpayer who uses his pull at the city hall to have his property assessment adjusted?

All this should give us more sympathy for the young person who step by step is drawn into a life of crime. There should be no doubt in our minds that he is worth saving. Even if our humanitarianism does not demand it our own self-interest is clearly served by doing so.

Many worth-while ventures in crime prevention have been developed and are in operation in our country. Usually these programs involve trying to help children who have become delinquent or who show signs of becoming so. We need to begin further back. Happy and well-adjusted marriages will help beyond measure because in the homes thus founded children can get the individual attention they require. Schools that recognize and take account of individual differences will see that every child is taught in accordance with his capabilities and that when his schooling is over he is ready for something.

The importance of having a suitable occupation, in which self-respect can be maintained, is difficult to exaggerate. Lawes tells of a young man with a long criminal record, including murder, who worked defiantly in the large knit shop of the prison for three years. Eventually he became interested in the techniques which the civilian barber-instructor was teaching to his class, and asked to become a pupil. He took great interest in this work and, finding his aptitude,

became one of the most skillful barbers. With the prospect of having a shop some day, Lawes said, "I knew that Leonard who ten years before had been proclaimed a vicious and incorrigible criminal had reformed, and was 'through,' as he put it, 'with the racket.'"

Men who have occupations suited to their abilities do not become criminals, and experience has shown again and again that the best chance of reforming a hardened criminal lies in the possibility of training him for some specific work that he likes. The prime need is for a feeling of self-confidence and self-respect.

3

What to do with the criminals when they commit their depredations? First, we must catch them. A scientific study of human beings can help in many ways to do this. We shall confine our discussion, however, to what can be done in the way of lie detection, or perhaps more accurately detection of deception. It is obvious that if lies and deception could be detected scientifically, it would be difficult for criminals to avoid conviction or for organized crime to exist.

There are several possible lines of attack which have been experimented with, of which we will mention only two—first, the detection of emotional reactions during deception by means of breathing records, blood pressure changes, and electrical responses in the skin, etc.; and second, the use of a suitable drug to render the subject incapable of fabricating a lie while under examination.

It goes without saying that no method has been developed at the present time to the extent that it can be considered fool-proof, or perfect even in the hands of experts. Otherwise the procedure would be in general use and a matter of common knowledge. Let us inquire, however, into the potentialities of these methods and what is being done to develop them.

The observations that blood pressure changes and changes in breathing records accompany emotional disturbances have long been known and for many years the possibility of using these and similar

criteria as a basis for lie detection has been considered. One of the disturbing factors is the wide variation in the blood pressure records and also the breathing records of individuals under normal conditions (see page 89), and the consequent difficulty of discerning deviations which result from emotional stress. If every individual breathed in the same manner normally or if blood pressure fluctuations always followed the same pattern normally, then it would be possible to construct an apparatus that would ring a bell whenever the emotional stress accompanying deception appeared. But what is normal for one individual is abnormal for another, and the records obtained in criminal cases are not interpreted with readiness or great precision.

Acquaintance with the breathing records and blood pressure records of many individuals under normal and abnormal conditions would eliminate much of the uncertainty about this tool, which is already of considerable value in criminal investigators. But research on individual differences, especially in the physiological realm, is in its infancy.

Unfortunately we, the public, are not well enough educated to appreciate fully the value of scientific investigations such as would be involved in the development of a deception detector. When better automobiles, airplanes, radios, electric lights, telephones, etc., are wanted, we make possible the expenditure of millions of dollars in research, but for the development of a lie detector, we aren't quite sure—there isn't enough precedent for it to convince us. Even the more conventional scientific research often has to fight for its life, but research on lie detectors almost doesn't exist.

The tools which have already been developed are valuable, but the findings are in general no good in court. Why? Because in order for a method to be accepted in court it must be generally accepted by scientists in the field involved. If physiologists and psychologists as a whole were in a position to vouch for the cardio-pneumo-psychograph, a form of lie detection apparatus, its findings could be accepted in court, but they are not able to do so, partly because probably 99 per cent or more of them are unfamiliar with

this type of investigation and would not be able to judge its merits. Investigation in this field is very meager and until a group of scientists of significant size is engaged in a particular type of research there can be no such thing as general acceptance. Inbau says, "The lie detector technique at the present time lacks not only the legally essential acceptance by psychologists and physiologists, but also their active interest in the potentialities of the technique." [2]

It is dangerous to promise anything as the outcome of research because there are always uncertainties, but I venture to say that a few hundred thousand dollars expended in research on lie detectors would yield apparatus which would be accepted by physiologists and psychologists and therefore by courts. This does not mean instruments that would be absolutely perfect—such are not humanly possible—but it would mean devices that would far surpass any now used for accomplishing the same results. The resources of science are not limited by any means to blood pressure changes, breathing pattern changes and galvanic skin responses. Temperature changes (minute but significant), changes in circulation, sensory reactions, finger tremors, brain waves, and other variables that might not occur to one off-hand, are among the items that might find use in connection with lie detection. If we took the job seriously it could be done, by concerted effort, relying possibly not on one but on several criteria.

The other type of lie detection which we will discuss briefly is related to the well known fact that when people are under the influence of liquor they often talk indiscreetly and sometimes to their own detriment. Dr. R. E. House, an obstetrician in Texas, discovered in connection with the use of the drug scopolamine for childbirth (twilight sleep), that patients who had this drug adminstered in the right manner and in the right amounts were able to hear and answer questions and that even though they were completely unconscious and unable to remember the incident later, their answers to questions were always in accord with the facts. This led him to investigate as best he could its possibilities as a means of eliciting the truth from criminal suspects. The results were

promising and the discovery received a lot of over-enthusiastic publicity in which the material was referred to as a "truth serum." (It has nothing whatever to do with serum.) Dr. House's attitude toward his discovery and the necessity for extensive investigation before it could be used widely was excellent. He died in the midst of his work with it, believing that his discovery had great value.

Scopolamine is a harmless drug when administered correctly. A series of individuals were awakened five hours after its use, no worse for the experience. They ate and enjoyed a hearty breakfast. Like any drug, however, scopolamine can cause trouble if carelessly used. When used according to House's technique it depresses the higher brain centers and under its influence the subject does not have the ability to make up a lie or follow through in a deception. One of the difficulties in its use is that the subject must be in just the right stage of anesthesia, and furthermore there are great individual variations in response to the drug. House said, "Scarcely any two patients are alike or require the same amount of medicine."

Obviously a study of individual differences in response to the drug must be made before it can be used extensively. House would have been happy to carry such work ahead but he did not receive the necessary help and encouragement. People were in a mood to take it as a ready-made perfect device or not at all. Since his day the whole investigation appears to be a dead duck, even though he did demonstrate his discovery on several occasions and presented his findings to medical societies.[3]

There is doubtless prejudice, based on ignorance and unfamiliarity, against the administration of any drug to a mere suspect. The fact that the drug *might conceivably* do the subject bodily harm is hardly a valid argument; when a suspect is moved from one location to another by automobile there is possibly even more danger of his coming to harm through an automobile accident. Furthermore it would not be absolutely essential to the use of this device that the drug be administered against the prisoner's will. If it worked satisfactorily, innocent people at least would be glad to submit.

One phase of this type of investigation is the recognition that

the possibilities are by no means limited to scopolamine. Other drugs behave in a somewhat similar manner. We have already mentioned alcohol; chloroform also has a similar effect and Dr. House at one time advocated its use along with scopolamine. In his later studies he also used a small amount of apomorphia in conjunction with scopolamine and chloroform. Dr. House worked under tremendous disadvantage, mostly alone and without adequate opportunity to determine individual reactions and to gauge them.

Scopolamine is an alkaloid belonging to the atropine family. It is a drug with many relatives. It seems reasonable to suppose that other related alkaloids might work better; or more likely yet, that organic chemists will be able to produce synthetic drugs that will be superior. None of the available drugs have been tried to see if they hold any promise for the purpose.*

Again, if we take the job seriously, there is no reason why House's technique cannot be perfected or a better one devised. It can never be done, however, in a wholesale fashion or until we study far more adequately the individual differences in responses to the drugs that may be used. By careful study of the preliminary reactions of the individual, which was done after a fashion even by Dr. House, it will probably be possible to gauge the proper dosages satisfactorily.

4

The problem of the way to treat criminals after they are found guilty is a real and compelling one and should be faced realistically, scientifically and without sentimentality or emotionalism. In the first place we should find out by study, if we do not already know, *what can be done with them.*

One theoretically possible method of dealing with all offenders is to exact the death penalty and be through with them once and

* The use of sodium amytal by army psychiatrists to get psychotic individuals to open up and talk about their troubles and experiences is an example of what may be accomplished in a closely related field.

for all. While this would possibly be a cheap way and would prevent overcrowding of our penitentiaries, there is not the slightest possibility that the public would favor it. If the death penalty were exacted on a scientific basis there would have to be careful sifting and selection so that the worst were weeded out. It is likely that on a scientific basis young sixteen-, seventeen- and eighteen-year olds might be saved and the neglectful parents might be sacrificed instead. This would not be a popular move.

Coming back to possibilities which are more realistic and recognizing that capital punishment except for a few is out of the question, we are faced with the fact that prisoners, if they are not done away with, must be handled in some manner.

A theoretical alternative is to imprison them indefinitely and protect society completely from their criminal acts by this means. This is clearly out of the question; about 1,500,000 felonies are committed each year; something like 300,000 arrests for felonies are made yearly, and our state and federal prisons have a capacity of less than 200,000. The life expectancy of prisoners on commitment averages thirty or more years, and if we did a reasonably good job of convicting felons and incarcerated them for life our prison population would be completely beyond endurance.

In view of the fact that we can neither exact the death penalty nor imprison criminals indefinitely, it is obvious that most of them must be turned back into society. This means that either they are turned back as criminals or as "reformed" criminals.

The only way we can know whether criminals can be reformed is by study and trial. What we obviously need is to know more about the individuals to be reformed and the methods which will work best to accomplish the desired results. If we go at it scientifically, the worst outcome will be that we will know that it can't be done, or at least that we don't know how to do it. A more likely outcome is that we will find that it can be done in the great majority of cases. Healy and Bronner, who made an extensive study in Chicago, go so far as to state that "no conditions, whether of mind or body or life situations, preclude the possibility of checking the develop-

ment of a criminal career." Whether this is overoptimistic remains to be seen.

It is clearly desirable, since criminals have to be returned to society sooner or later whether reformed or unreformed, that the effort at reformation should start at the earliest possible time, and that any foolish and extravagant ideas about abstract justice, and any costly thought of revenge that will conflict with this purpose, shall be thrown out the window.

To carry this forward individual criminals must be studied scientifically and thoroughly. From the standpoint of dollars and cents alone they are eminently worth studying. We know enough now to envisage some of the results of thorough study. We can guess that we will find criminals to have individuality traits which have precluded their easy adjustment to society as they have seen it, and that society has made a tremendous mistake in assuming that they should fall into an artificial generalized pattern. There is no such thing as a normal human being to be set up as a standard pattern which all personalities should follow. Let me repeat: more definite knowledge about criminals must await further scientific evidence, but everything that we know seems to point to their individuality and the lack of recognition of it by society, as the fundamental difficulty.

We shall probably learn by further study, if indeed we do not already know, that the only hope of reforming a criminal is to know him individually and once having found out what his traits and abilities are, to devise ways and means whereby these traits and abilities can be used in constructive, valuable ways. With present restrictions which surround almost all productive labor on the part of penitentiary inmates, it is difficult to see how they can be trained along the lines of their aptitudes. Not all would or could take to barbering, as in the case cited above, but the great majority would take to something, if their traits were known and a chance were afforded to use their distinctive abilities.

There is obviously no simple formula, nor under present conditions any practical scheme, for the proper treatment of criminals. We can be sure that any plan that neglects to recognize their dis-

tinctive traits and the well-nigh universal desire for recognition and self-respect, is destined to fail.

The almost hopeless situation which we have arrived at, in connection with the possibilities of turning back to society reformed rather than unreformed criminals, should make us all the more attracted by the possibility of preventing crime in the on-coming generations.[1] It will take more than an ounce of prevention but there is no reason to think it will tax our capacities. If we apply to the elimination of crime some of the effort and zeal which we exhibited in the conduct of the recent war we can go a long way. We must start at the beginning. Progress in building happier, more well-adjusted marriages is indispensable; recognition in the homes and schools of individual differences and development of education which fits each individual, are also essential. These efforts will pay for themselves in many ways and will take the place of the incomparably more difficult task of reformation.

XIII. Medicine and Medical Research

To a person who appreciates the variations which exist among human animals, the remarkable thing is that in spite of these great personal differences there are some sicknesses in which the majority of patients do follow a very similar course.

DRAPER, DUPERTUIS AND CAUGHEY

BEFORE DISCUSSING the contribution of humanics to medical advance, it will be necessary to discuss briefly some of the background information regarding medicine and medical research as they exist in this country.

The number of physicians in the United States is larger in proportion to the population than in any other country—approximately one physician for each 750 people. The total number of physicians is about 170,000. Each year (pre-war) approximately 5,000 retired or died and their places were taken by about the same number of medical school graduates.

We are here concerned primarily with provisions for the development of medical research. The attitude of typical medical students toward this is made clear in the *Final Report* (1932) of the distinguished Commission on Medical Education.[1]

Not infrequently as a part of either a thesis or elective work in a course [medical] students work on minor problems or take part in some major research work. . . . These efforts should not be taken too seriously as contributions to the advancement of knowledge. . . . Occasionally these contacts with unsolved problems have challenged students whose interest had not been aroused previously and have marked the beginning of a productive career in research.

Most medical students, however, are not primarily interested in and ordinarily do not have either the ability or enough free time to conduct

independent research. It is difficult for even the best students to do all the work satisfactorily which is provided in the regular medical course and very few can successfully combine that work with additional activities of a research character.

After the regular medical course, an internship in a recognized hospital must be served and this is frequently followed by an assistant residency or a residency, which is the common manner in which graduate training in medicine is obtained. Apparently about one-fifth of the medical graduates complete such two-year graduate appointments.

Concerning research during this residency period the Commission on Graduate Medical Education says:[2]

> The resident [physician] who has special aptitude should be encouraged to undertake a properly organized project of significant interest. . . .
>
> Many educators are critical of those institutions that require all graduate [medical] students to attempt research, feeling that much of it is meaningless and that the time is too short for the completion of a problem, or that it absorbs too large a percentage of the student's interest before he has obtained a broad basic understanding of his subject.

It is clear from the above statements that even graduate medical students are usually not regarded as well equipped for research and that investigation and the advance of medical science are a minor item in the program, undergraduate and graduate, of medical students.

Before discussing further the question of who is responsible for medical research and where it is done, it will be well to note the difficulties of defining medical research and distinguishing it from non-medical research. We may best do this by considering specific cases. When Roentgen discovered X-rays in 1895, was he doing medical research? Were Mme. Curie's classical investigations which led to the discovery of radium the result of medical research? How about Fleming's discovery in 1929 of penicillin, the powerful antibacterial agent which he found to be produced by a certain kind of mold? Many basic discoveries such as these—those of the chemi-

cal sulfanilamide and the vitamins for example—have not been the products of medical research but have been contributed by chemists, physicists, bacteriologists and so on, who have been interested in their own specialties. Medical research, more properly speaking, is not concerned with fundamental discoveries like those mentioned but with the development of medical uses.

Since the lines are not easily drawn we can probably make the meaning clear most satisfactorily by limiting medical research to that done in connection with medical schools, hospitals, medical research institutes (endowed or operated by private concerns), and public health laboratories. Such research has usually a *direct* bearing on medical practice.

Statistical or other co-ordinated information on medical research in this country is scanty. Gregg speaks of "the poorly cultivated fields of clinical research" and tells of many ways in which a medical research career is made unattractive. He says: [8]

> In some schools we have noted with regret that the delicate beginnings of the research attitude, often inspired during the pre-clinical years, are discouraged if not altogether killed by clinical teachers, so that students never turn their faces again to the laboratory sciences.

Concerning the early career of a prospective medical researcher at a $1200-a-year salary, Gregg says:

> He is shocked to find how much he needs more mathematics, more chemistry, more physics. He is discouraged by the slender residium of useful knowledge his college days provide him. . . . His idea of a substantial salary after four years of college, four years of medical school and five or six years of special work is $2500 to $3000. . . . Five years after graduation the ablest of my contemporaries were making $10,000 a year in [medical] practice and have continued at that level or above it. The equally able men who went into [medical] teaching or research were at $3000 after six years and few have worked up to $9500 twenty years later.*

* From *The Furtherance of Medical Research,* by Allan Gregg, copyright 1941, reprinted by permission of Yale University Press.

A sampling of the pages of the latest edition of *American Men of Science* indicates that about 2800 men in this country are engaged at least part time in what may be regarded as medical research. This includes research in such diverse branches as surgery, psychiatry, pathology and public health. Many of the men included in this list are practicing physicians, some of them on the staffs of several hospitals, and it is obvious to anyone acquainted with the life of a physician that the proportion of their time and energy devoted to research must be very small indeed. Many others are professors in medical schools who have only part time for research. On the basis of the available information it would appear that for every hundred practicing physicians there is less than one man devoting his full time to research and advance in medical practice. It is obvious, if this is true, that there would be a tremendous step ahead in the support of medical research if the suggestion were followed of adding to the doctor's bill 5 per cent to be used for research upon the disease that the doctor has treated.

Much of the medical advance of recent decades has been due to the activities of private foundations and is not based on public support. In addition progress has been increased by a great number of contributions from investigators who are entirely outside the field of medical research proper. As medicine advances and becomes more highly specialized, this resource will diminish in importance. We have no reason to be proud of our record in strictly medical research nor complacent about its future.

As evidence that direct medical research has lagged in recent decades we may cite the fact that niacin (nicotinic acid), discovered in 1938 to be highly efficacious in the treatment of human pellagra, had been known and available to chemists since 1867. It was found in crude vitamin preparations in 1911 and later, and if medical research had been active and well-supported even trial and error testing on pellagrins might have demonstrated its effectiveness ten to twenty-five years earlier.

Sulfanilamide was known to chemists for thirty years before it came into use in medicine. It was six or eight years after highly

promising results were obtained by Domagk on a closely related drug, before sulfanilamide came into common use. There were fourteen years between the discovery of penicillin by Fleming in 1929 and the first time a substantial number of human cases were treated. If it had not been for the beneficence and farsightedness of the Rockefeller Foundation the use of these phenomenally important chemicals would have been delayed many years more.

In 1932 Mead Johnson & Company offered an award of $15,000 for clinical research. The terms were as follows:

> The award will be made to the investigator (or group of investigators) who (1) determines the clinical value of vitamin A (if any) in human medicine, or (2) determines the vitamin A requirements of human beings or (3) determines whether vitamin A in amounts more than contained in a well-balanced diet is of benefit in human physiology.

Year after year passed with no contenders for the award, and four of the seven original judges died; finally, after thirteen years, the judges, with four replacements, advised the donors "that it is their considered opinion that no report or reports have been published which adequately answer any of the three stated requirements of the award." They also expressed the belief "that no adequate answer to the problems as formulated will result from current research," and recommended that the award be revoked.[4]

This means that clinical research seriously failed in this case, and as a result *we do not know on the basis of clinical trials whether vitamin A has clinical value, how much human beings need, and whether abundant amounts are beneficial to health.* On the basis of animal experiments, this vitamin stands out as important as ever. One complication which probably renders the task more difficult than it otherwise would be is the probability that human beings differ widely from person to person in their requirements of vitamin A and their response to it. This is hardly an excuse, however, for folding up and abandoning attempts to find out.

The situation with regard to vitamin A is not unique. Direct knowledge of what various members of the vitamin family can do

in the medical field is scanty and it is partly because of this that we have to listen on the radio to half-true quacking generalities and inane sales talks about products which may or may not be intelligently compounded. I could name at least a half dozen vitamins discovered in recent years, the medical uses of which are essentially unknown and unexplored. There aren't enough medical research men to do even a substantial fraction of what needs to be done!

If a chemist in the course of laboratory investigation discovers a drug which shows promise of being useful medicinally, what can he do about it? Experience shows that it is far from simple to get such a drug tested, even if it shows excellent promise. If it promises to be useful in connection with some widespread disease and is the type of compound which can be patented and exploited commercially, the opportunities for having it tested therapeutically are increased. However, purely scientific information is generally hard to get because of the dearth of medical researchers.

2

One fact overshadows all others in the need for medical research in the future, and it applies as well to research of a more basic and fundamental nature. It is the recognition that individual people—the prospective patients—are by no means identical metabolically, physiologically, psychologically or in any other way. What is one man's meat may be another's poison, and this issues a new challenge to medical research. It is essential that adequate knowledge be built up so that medical treatment can meet more effectively the needs of individual patients.

We have previously called attention to the fact, which will become more obvious as a result of our further discussion, that the present fundamental education of medical students which precedes their clinical study is based almost wholly on a knowledge of man-in-the-abstract and takes virtually no notice of the wide differences between individuals. Normal individuals, normal physiological responses,

and therapeutic measures that bring normal results, are their stock in trade.

Possibly the best indication of the attitude on this point is to be found in medical books in current use. *The Physiological Basis of Medical Practice,* a book of nearly 2000 pages, published in 1943, may be taken as an illustration. It is chosen because of its general excellence and authoritative character. The authors are Best (of insulin fame) and Taylor of Toronto. In spite of its general excellence one looks in vain in the sixty-eight-page double-column index for such entries as "idiosyncrasies," "individual differences," "constitution," or "types," and finds no evidence that anywhere in the body of the book individual responses are considered seriously.[5] *Man-in-the-abstract* is clearly the basis of discussion. Such topics as blood groups are of course discussed, but there is no hint that these groupings may have broad physiological implications or be of any importance except in specific phenomena associated with blood transfusion.

Another book chosen because of its general excellence is *The Pharmacological Basis of Therapeutics* (1941, about 1400 pages) by Goodman and Gilman of Yale. Individual differences in response to drugs are treated under the heading "Idiosyncrasies." One paragraph explains that idiosyncrasies are abnormal, unusual and unexpected drug responses, but no hint as to their possible significance is given. In other portions of the book several specific idiosyncrasies for individual drugs are cited briefly without interpretation. We shall refer to one of these cases later.[6]

3

But there are strong tendencies in some branches of medicine to take the matter of individual differences seriously. Probably the psychiatrists are the leaders, and it is not uncommon to see the general statement that there are about as many kinds of mental disease as there are diseased individuals. This does not mean that psychia-

trists do not attempt to classify their patients or that they treat them purely on an individual basis. This would clearly be impracticable, but there is a general agreement that mental difficulties are often of a mixed nature and that in an individual case to follow anything like a rigid pattern of treatment prescribed for a given type would be a mistake.

One of the earlier books in which a study of individual differences was seriously considered as a promising experimental approach to a study of medical diagnosis and treatment was *The Biology of the Individual,* published by the Association for Research in Nervous and Mental Disease in 1934. In the chapter, Constitution and Internal Medicine, Barker cites Kretschmer's well-known classification of most human beings into pyknic (Greek, thick), asthenic (Greek, weak), and athletic types, as perhaps the best grouping yet devised. He emphasized briefly the importance of constitution in connection with high blood pressure, apoplexy, angina pectoris, gastric and duodenal ulcers, spastic constipation and diseases of the muscular and nervous systems. The pre-eminent position of the grossly oversimplified classification of Kretschmer is indicative of the undeveloped status of the subject at that time.[7]

Other chapters in the same book stressed the importance of individual variance primarily from the standpoint of mental disease.

Another evidence of a stirring interest in individual differences in medicine is the formation and development of the so-called Constitution Clinic of the College of Physicians and Surgeons, New York, and the publication from that clinic in 1944 of *Human Constitution in Clinical Medicine* by Draper, Dupertuis and Caughey. This contribution came to my attention when this book on humanics was about half written. I was much pleased to find that, for the field of medical practice, the authors had already adopted a point of view similar to my own. The fundamental idea of the Constitution Clinic is "to incorporate with its study of sick persons any new method which might further illuminate an individual's constitutional type."[8]

The two chapters on constitutional physiology are particularly

germane and illuminating to our discussion, since they deal with some of the points which we have stressed:

First, in human beings one can never understand body function except in relation to physique, psychological pattern, and the stress of internal and external environment. And, second, since no two human beings have the same physical equipment and emotional background, every human reaction must be considered as a unique performance by an individual whose behavior is determined not alone by the basic rules of physiology, but also by his personal constitutional status at the moment. . . .

The "normal range" of resting heart rate serves as an illustration of the point of view. There are healthy persons whose heart rate seldom exceeds 50 per minute at rest, and others whose resting rate is seldom less than 100. Although one may say the normal range of heart rate is between 50 and 100 per minute, this statement contributes little to any analysis of circulatory dynamics. The actual fact is that a pulse of 70 may be fast for one person and slow for another. To the constitutionalist, the observed pulse rate is an indication of the momentary balance in the individual between the many factors which produce cardiac acceleration and the equally numerous forces which cause deceleration, operating on the cardiovascular apparatus with which the individual happens to be endowed. . . .

Another field of physiology in which failure to understand individual differences leads to utter confusion is the broad realm of energy metabolism and body weight. To the student of constitution there is nothing more ridiculous than the general acceptance of the idea that a person's normal weight can be determined simply by reference to a "height-weight" table. . . .

Although results obtained by averaging the observations made on a large series of people have value, the striking of an average tends to submerge the individual quality of the diverse organisms that comprise the group, and the results apply therefore only in a vague way to any discussion of the personal quality of the unique human animal. . . .

It is not difficult to devise pharmacological tests which are sufficiently safe for use on human beings. . . . All of these tests have one thing in common, namely, marked differences in the pattern of reaction shown by different individuals. This is the only clear fact that emerges from the many investigations of this type which have been carried out. Most workers, however, have not been satisfied with this simple demonstration of individual differences in response to drugs. They have gone

ahead to use these data for the formulation of elaborate theories of autonomic physiology and the observed facts have been submerged under the mass of interpretive comment. . . .

If a patient behaves very badly in response to a given medication, it is called an idiosyncrasy, but if he responds very favorably, that is called a brilliant effect of the drug, and the patient's individual peculiarity in respect to this pharmacological experiment receives no comment.*

Kraines, in his excellent book dealing with psychoses and neuroses also emphasizes the importance of constitutional predisposition in connection with numerous conditions; functional disorders, disease, and psychotic disturbances. It is high time that medical research be more adequately supported so that ignorance regarding individual differences will not be so profound.[9]

The stirring of interest in individual differences, as they concern medical practice, is shown also by the new movement called psychosomatic medicine. The word psychosomatic denotes mind-body relationships and the relatively new journal *Psychosomatic Medicine,* which was started in 1939 with the assistance of the Josiah Macy, Jr., Foundation "is to encourage and bring together studies which make a contribution to the understanding of the organism as a whole, in somatic and psychic aspects." While this quotation refers to "the organism as a whole" and hence to man-in-the-abstract, nevertheless the tie-up with psychology and psychiatry, where individual differences are recognized and often stressed, will ultimately insure serious attention to individual differences. It will be impossible to make serious advance in psychosomatic medicine as long as man-in-the-abstract remains the consistent theme, and one can see leanings toward a serious consideration of individual differences in the contributions to the journal.

There has never been a time when individual differences have been totally ignored in the medical field and skillful and competent physicians have probably always relied on observation and common

* From *Human Constitution in Clinical Medicine,* by G. Draper, C. W. Dupertuis and J. L. Caughey, Jr., copyright 1944, reprinted by permission of Paul B. Hoeber, Inc.

sense to guide them in this matter. This intuitive, common-sense approach is no doubt valuable as far as it goes, when the physician possesses the necessary qualities, but it is a poor substitute indeed for scientific information.

In particular instances the need for recognizing and attending to individual differences has been driven home as the result of repeated observations. For example, in *The Pharmacological Basis of Therapeutics,* referred to above, it is emphasized that in connection with the effects of tobacco individual differences must be ascertained and recognized. In concluding the discussion on the use of tobacco the authors say:

> In summary it may be stated that *each patient must be studied carefully in an attempt to decide whether in his case* tobacco is producing chronic intoxication [emphasis supplied]. Although tobacco is contraindicated in Buerger's disease and in nicotine amblyopia no generalities can be stated regarding the deleterious effects of smoking on patients with other disease syndromes. It is unfair and often unnecessary to request one to give up smoking, unless the evidence is of a much more convincing nature than is usually advanced.*

The necessity for individual study is emphasized, but *how* the doctor is to study the patient and find evidence for chronic intoxication in a specific case is not specified. Only an *attempt* to decide can be made, and then only on a flimsy basis, as long as our knowledge of individual metabolic and physiological differences is as scanty as at present. There is no gadget which the physicians can turn on a patient in order to determine whether he is tobacco-resistant. The usual procedure is for the patient to smoke (if he wishes) until he reaches the age of seventy. If he is still alive and is also not afflicted with either Buerger's disease or tobacco ambylopia, this is pretty good evidence that he is one of those resistant specimens referred to earlier in connection with Pearl's statistical study.

There are various other phases of medical practice where common

* From *The Pharmacological Basis of Therapeutics,* by L. S. Goodman and A. Gilman, copyright 1941, reprinted by permission of The Macmillan Company.

sense has demanded that individual differences be recognized. Certainly one of the possessions of a skillful anesthetist is the ability, based on observation and intuition, to judge the numerous details of administration. This is a matter which is handled on an individual basis and individual responses to specific anesthetic treatments are known to vary widely.

In the field of allergies the existence of individual differences is also clearly recognized. It is estimated that about 15 per cent of all people in the United States are affected to a greater or lesser degree. One authority says, "Allergy is one of the most consistently hereditary of all diseases." Although there is much that is obscure in allergies, the fact that no two individuals can be expected to respond in exactly the same manner is a clear-cut fact. We have already mentioned that some react to an allergen by symptoms such as sneezing, etc., some by hives, and some by gastro-intestinal disturbances. In addition to these differences there is a wide variability in the degree of sensitivity to any specific allergen. Some individuals who are definitely allergic to egg proteins are insensitive enough so that they can eat eggs occasionally but are made very ill if they eat them several days in succession. Others cannot eat eggs as such at all but can tolerate the amount which they obtain, for example, in cake. Others are so sensitive to infinitesimal amounts of egg, that they may be made ill by kissing an individual who has eaten egg.

Obviously man-in-the-abstract never suffers from allergies; it is only actual men, women and children who suffer and their cases must receive much individual attention. The differences in allergic responses is based upon fundamental differences in physiological and metabolic make-up. To date these differences are obscure. They are not likely to become clarified until individuals are studied more exhaustively than they ever have been. Physicians who have made a special study of allergies believe that allergic tendencies are associated with recognizable personality traits. While this seems entirely likely and plausible the evidence on which such a belief exists is unsatisfactory, because the personality traits concerned have not been measured but have been judged only subjectively.

Other phases of medicine in which individual differences are well recognized are skin grafting—from one individual to another—and the transfusion of blood. In these the fundamental biology of one individual is made to impinge directly upon that of another individual, and man-in-the-abstract doesn't enter into the picture.

The day is coming, I believe, when individual differences will be recognized and studied not only in connection with a few conditions, but in their application to all manner of diseases and treatments. When that day arrives there will not be so many people with difficulties which are beyond professional help. At present numerous cases exist in which physicians admit that they are baffled and unable to be of assistance.

4

Actually there are already several diseases in which individual differences are known to enter in a striking fashion.

In the gay nineties when in our cities typhoid fever killed 1000 or more people for every one it kills now, an important cause was the existence of undetected typhoid carriers. These were people who exhibited no symptoms of the disease and yet carried the germs with them continuously. From 2 to 10 per cent of all people who have the disease evidently become carriers—some for a period of a few months only, others for years. Some who never contracted the disease, so far as outward symptoms were concerned, nevertheless harbored the typhoid bacilli continuously, often in the gall bladder, and were capable of spreading infection by way of the intestine at any time.

In respect to typhoid fever the following types of individuals exist: (1) those who resist the disease in all its aspects; (2) those who resist its harmful effects but carry the germ to others; (3) those who contract the disease but throw it off completely at convalescence; (4) those who contract the disease but harbor the germs for a few months thereafter; (5) those who contract the disease but

harbor the germs for a long period thereafter; (6) those who have only mild symptoms of the disease (walking typhoid) and recover slowly.

There is no question about the desirability of having sanitary conditions such that typhoid is completely eliminated. Nevertheless wide differences in the potential response to typhoid germs exist in different people and an insight into the why of these differences would be illuminating. Especially would this be so if these differences were correlated, as we would expect them to be, with recognizable biochemical, physiological and psychological traits.

Scarlet fever is another infectious disease in which wide variability in response is exhibited. Almost everyone has an even start in life as far as this disease is concerned, in that we have complete immunity for the first year or so. For large numbers, including Negroes as a group, this natural resistance to the disease remains throughout life, and even though they may be exposed they do not contract it. Cecil in his *Textbook of Medicine* says, "The fact that so many people exposed to the disease do not contract it, suggests that much scarlet fever is unrecognized." This means that they have mild cases which can be called scarlet fever only through courtesy to the causative agent, since the scarlet rash and the fever are both absent.

Many individuals become susceptible to the disease after the first few years of life, but this is variable. Most cases develop when the children are from five to twelve years old. The disease varies greatly in severity and in many cases this is due to innate differences in the individuals concerned. Before modern treatments were devised, it was not uncommon for the disease to appear in one family in a severe form, killing four or five children in succession. In the same epidemic another family might have light cases. This, along with the other known facts, including the complete resistance of many white people and most Negroes, suggests strongly that one's physiological make-up in some way determines his reaction. Various complications may or may not accompany or follow the disease, in the kidneys, in the middle ear, inflammation of joints, infection of lymph glands, and disturbances in the heart. The existence or non-

existence of these complications is doubtless determined to a large extent by the patient's anatomical and physiological make-up.

Whether a child is or is not susceptible to scarlet fever can be determined by the relatively simple Dick test.

In these two infectious diseases, typhoid and scarlet fever, there are no outward characteristics (except the specific response to the toxin as in the Dick test) whereby susceptible and non-susceptible individuals can be differentiated, and we can only infer that physiological or anatomical characteristics probably lie at the basis of the differences in response. In the case of infantile paralysis—poliomyelitis—however, there are outward physical signs of susceptibility. These indicate that some children contract the disease and others do not because of innate anatomical and physiological differences, and that the progress of the disease is probably likewise determined by these differences.

The Constitution Clinic of the College of Physicians and Surgeons, referred to above, was brought into existence as a result of observations made during the infantile paralysis epidemic of 1916. Draper was led to the conclusion at that time that children who were stricken with the disease had observable physical and personality characteristics, an idea which, however, was not new since other physicians had mentioned such observations earlier.

An intensive study involving a mathematical analysis of a series of measurements of infantile paralysis victims as contrasted with uninfected children led to the conclusion that in the age groups five-to-eight and above twelve the afflicted children possess a significantly larger head and face size, have a greater interpupillary distance, greater breadth between the inner canthi of the eyes, and longer eye slits. It is evident that the rhythm of growth is different for susceptible and non-susceptible children, and the differences in growth rates which appear during earlier and later periods do not exist during the period when the children are from eight to twelve years old.

Observations as distinguished from measurements are also the basis for recognizing susceptible and non-susceptible children. Six

observable characteristics have been selected in the Constitution Clinic as being especially significant: (1) presence of black pigment spots on the skin; (2) presence of long curved eyelashes which remain long during advancing years; (3) presence of large incisor teeth; (4) presence of spacing between the central incisor teeth; (5) pronounced hyperextension of the joints, and (6) presence of internal eye folds. In every one of these cases there is a significant positive correlation between the possession of the characteristic and susceptibility to infantile paralysis, as judged by actual incidence.

It appears obvious that a study into the roots of poliomyelitis must involve attention to individual cases. Indeed, as we have seen, by measurement and observation it is already possible to identify susceptible individuals with considerable accuracy. If the underlying cause of the differences in developmental growth could be determined it might be possible to correct it (possibly by glandular therapy) and make every child resistant, or if being forewarned is being fore-armed, it might be possible to give special protection to susceptible children. In the development of cures and treatments it is clear that intimate knowledge about individual cases is essential, because when and if the disease is contracted there is wide variability among individuals as to the course which it takes.

Conditions which go under the general designation of colds are important economically because of the large loss of time they entail and also because of the numerous complications which may arise in connection with cold symptoms. There is possibly no field in which individual differences are more prominent or where attention to them would bring more definite results.

A cold is a very indefinite disease, and we can hope for progress only when this is fully recognized. To search for *the* cause of the common cold is probably about as scientific as to search for *the* cause of itchy skin. A multitude of agents may irritate and cause itchy skin and it is probable that numerous infective agents can affect the mucous membranes of the nose and throat in such a manner as to produce symptoms of a cold. For a given individual there may be a kind of cold which is highly typical, but the same individual

may from time to time have different types of colds and it is a crudity to think of a cold as being a single disease with uniform characteristics regardless of the infective agent or the victim's individuality.

In this connection Draper, Dupertuis and Caughey say:

> Because most clinical teaching is predicated on the idea that any single disease is a pathological entity with appropriate symptoms, physical signs and laboratory findings, many [medical] students draw the conclusion that there is a "textbook picture" for each of the diseases that they study, and that deviations from this accepted pattern cannot be explained on any sound basis. To a person who appreciates the variations which exist among human animals, the remarkable thing is that in spite of these great personal differences there are some sicknesses in which the majority of patients do follow a very similar course.*

Not only are individual differences important in connection with the particular infectious diseases already mentioned, but in the large group of virus diseases an individual's predisposition is of great importance.[10] Rheumatic fever is a disease of somewhat obscure origin, in which individual predisposition is strikingly important.

If variabilities are important in infectious diseases which depend upon the activities of invading organisms, they are likely to be even more important in metabolic and other diseases which depend directly upon the physiological aspects of the body's activity.

A large number of diseases show their relation to individual differences in metabolism and physiology by the fact that they occur in one sex consistently to a much larger extent than in the opposite sex. Ninety-eight per cent of all cases of gout are in men, 83 per cent of cases of pyloric stenosis in children are observed in boys, 83 per cent of duodenal ulcers are in men, 82 per cent of carcinoma in the head of the pancreas are in men, as well as 75 per cent of the severe cases of coronary sclerosis. On the other hand 91 per cent of the cases of toxic goiter and carcinoma of the gall bladder are found in women, as well as 90 per cent of all cases of osteomalacia,

* From *Human Constitution in Clinical Medicine,* by G. Draper, C. W. Dupertuis and J. L. Caughey, Jr., copyright 1944, reprinted by permission of Paul B. Hoeber, Inc.

86 per cent of myxedema, 83 per cent of gallstones, and 75 per cent of all rheumatoid arthritis and chorea.[8]

These wide divergences have the possibility of deep significance in physiological sex differences which are still obscure. The diseases noted here include none affecting organs and tissues involved in reproduction in which, of course, we should expect sex differences. But the tissues in the pyloric region of the stomachs of males are different in a significant fashion from the same tissues in females; otherwise stenosis and ulcers would not occur so much more readily in males. Likewise, the thyroid glands in the two sexes must be significantly different or toxic goiter and myxedema would not be so predominant in women. If the innate characteristics of these and numerous other tissues are different in males and females, it follows that variance in these tissue characteristics is also to be expected among individuals of the same sex.

In numerous diseases the importance of innate individual differences is indicated—for example in gastric ulcer, duodenal ulcer, pernicious anemia, acute rheumatic fever, hypertrophy of the prostate, gall bladder disease, migraine, toxemia of pregnancy, carcinoma of the breast and uterus, diabetes, goiter and arthritis.

Draper and his co-workers point out how important individual differences are in connection with convalescence. They say:

> The variables which enter into the formula for convalescence in each patient are so numerous and so intimately connected with the total personality of the individual, that standardization of procedure is less possible here than anywhere else in clinical practice.

In recent years, because the average age of the living population is rapidly rising, there has been an increased interest in the processes of aging and in medicine as applied to older people—called geriatrics. It is obvious that in growing old there is a tremendously wide variation among individuals and that a study of aging as it applies to man-in-the-abstract can never be of the greatest significance.

Psychiatrists have been among the leaders in recognizing the importance of individual differences; it seems unnecessary to press the

point that in the field of mental disease and psychosomatic medicine the possibilities of the recognition and study of individual variability are outstanding in comparison with other fields of medicine.

5

On the basis of admittedly incomplete proof and personal observations, it seems likely that medicine has missed the boat on several occasions because of the general scientific bias in favor of man-in-the-abstract. Numerous remedial measures which would be highly effective *for some individuals* have apparently been discarded and discredited without warrant because they have been found not to be of universal application—measures which might have helped some have been left unused because they would not help everybody.

One of my former graduate students unwittingly presented me with a bit of evidence on this point which will serve as an illustration. He had been a frequent victim of severe and rather typical attacks of migraine headache, which seriously affected his work and his whole life. Being of a studious and investigative nature, he informed himself as well as he could regarding the disease and when he received no substantial medical help he began experimenting in a mild way upon himself, keeping records of his attacks and symptoms. After some years he hit upon the observation that when he became very thirsty (he lived in a desert area) and drank water freely, he was liable to precipitate a migraine attack. This led him to try limiting his water supply and never quite satisfying his thirst. The experiment worked with a high degree of satisfaction and when he was with me as a student he was fully convinced that he had solved the problem. He said he had by this means kept himself absolutely free from migraine attacks for many months, but that by actual trial he knew he had only to imbibe freely at a drinking fountain to bring on an attack.

With a dearth of strictly medical research there is no mechanism whereby an idea such as this one can be given an adequate trial. It

has plausibility, because it is well known that headache can be caused by pressure in the cranial cavity and that surgeons when they wish to operate on the brain use diuretics to cause the brain to lose water and shrink. It looks as if this graduate student had solved the migraine problem so far as he was concerned; whether he solved it for any substantial number of other people remains unknown. Any claims might be met by negative evidence. Even if his idea had merit, probably some migraine victims would find the method ineffective, and because of our interest in man-in-the-abstract we are inclined not to accept or even try measures unless they are purported to be of general use. It is scientifically possible that search for *the* remedy for migraine could go on and on indefinitely without ever achieving success but that a recognition of different types of individuals would lead to a series of independent treatments which, when used in appropriate cases, would lead to the relief of all.

Because of my activity in the field of vitamin research a number of examples involving vitamins have come to my attention, which are suggestive along the same line. It seems pretty clear on the basis of evidence already available that each individual has vitamin requirements which are somewhat distinctive. We do not know the vitamin requirements of any individual nor have we anything like adequate ideas of how wide a spread exists in the requirements of different people.

Among the cases that have come to my notice are two involving pantothenic acid, a vitamin which I discovered and named. A trained nurse, after making arrangements by telegraph, made a trip of several hours' duration to tell me gratefully of her experience. Her story was this:

She had been in government service but had gradually become afflicted so that ultimately she was discharged as a mental case. Her principal difficulty, she said, was inability to remember everyday items associated with her work. When she was supposed to have a Sunday off, she would show up for work anyway, having forgotten what day of the week it was. More serious, undoubtedly, was the

fact that at other times she would be forgetful about her work or would be missing from work because she had forgotten the day of the week. She told me that remembering such simple things was literally impossible for her.

During the period when vitamins began to be used widely, she became a vitamin fan, or faddist if you will, and took the various vitamins that came on the market. When calcium pantothenate became available she took it on general principles rather than because of any specific help she expected to get. Much to her surprise her hair, which had turned almost white, began to resume its former color. She had not heard of this vitamin possessing anti-gray hair properties and she did not particularly care for the change which she observed in her hair. She did, however, bless me quite sincerely as a benefactor of the human race because the taking of the vitamin had (she thought) renewed her faculties so that she was capable of carrying on regular work and her memory was completely restored. As evidence on her memory, she said she had been involved as a passenger—but not injured—in an automobile wreck and that in the litigation several months later she was able without difficulty to remember the details and give coherent testimony. In fact she told me that an attorney had gone out of his way to compliment her on her testimony, saying that it was the best or one of the best pieces of straightforward testimony that he had ever heard a witness give. The entire conversation with this person seemed to be in line with the supposition that she was giving a clear-headed and accurate picture of her experiences.

With respect to the anti-gray hair properties of pantothenic acid, it seems reasonably sure that it cannot be counted on to restore the color of gray hair in human beings in general. In some cases, however, it appears to do so, and this is in keeping with our knowledge of individual differences and the fact that in strains of experimental animals which originally are black (rats, mice, dogs, chickens), lack of the vitamin induces gray hair (or feathers) and replacing it in the diet restores the original color.

The nurse's experience with respect to her memory is, so far as

I know, almost an isolated instance, though Gordon did report in a few cases great improvement in mental condition, which he ascribed to the administration of pantothenic acid.[11] Of course, any claim that calcium pantothenate will restore memory to all people or will improve the condition of mental cases in general would be promptly met by contrary evidence, whereupon people would then look upon the whole thing as a fake. Several explanations can be offered of the example in question: it may be that the nurse was suggestible and spontaneously recovered from her mental illness; it may be that she is one out of a hundred or one out of a thousand cases of her kind, and that all the others would fail to respond. Possibly the chance of calcium pantothenate having a beneficial effect on memory in such a case is 1:10, 1:5 or 1:1. No one knows until it is tried.

If we discard all beneficial measures until we find one which will work for everyone there is an enormous waste, and our search for the one may be for something that doesn't exist.

Another instance relating to the same vitamin is also worth considering. A woman whose hair was turning gray was advised by her beautician to try taking calcium pantothenate. The effect on her hair was entirely satisfactory but she received another more valuable benefit which she was not looking for at all, and hence it is difficult, as in the case of the nurse, to explain the results on the basis of suggestibility. Incidentally, she was a woman of unusual intelligence and education and not temperamental. She had been a lifelong victim of constipation, but upon taking calcium pantothenate regularly she found herself to be completely rid of the difficulty. Whether other people are affected in a similar manner or not, she is convinced that it has been of inestimable value to her.

Since the metabolism of each of us is somewhat distinctive, it is probable that some individuals have a high requirement for this vitamin (as well as other specific ones) and that as a result of a tendency to excrete or burn the vitamin excessively they are benefited to an unusual degree by its administration. Only serious attention to individual cases will reveal the facts.

Probably any doctor of long experience could cite, after reflection, a good many examples of medical discoveries which appeared highly promising at one time but were later completely discarded. How many of these might still be useful *for some individuals* no one knows, but it seems very likely there has been a large waste because of our general insistence that discoveries to be useful must be applicable to all individuals.

6

Medical diagnosis and treatment on a purely individual basis is to a considerable degree impractical, especially so for ordinary people of moderate means. Physicians are hardly trained for the task of looking exhaustively into the minute details of the anatomy and physiology of one patient, and if they were, patients could not usually afford to pay for the services rendered in a closely individualized study.

What seems to be required for individual needs to receive attention in a practical manner is that each person shall, for purposes of medical attention and treatment, be typed or placed within an appropriate group in much the same way that people are typed before they receive or donate blood in transfusions. In practice the four blood types O, A, B and AB are adequate in most cases. Investigation into individual differences may reveal that it is desirable to classify people in perhaps four types with respect to pulmonary tuberculosis, in heart disease perhaps six or more types and a similar number of types for nephritis, several for diabetes, and so on through the known diseases. For diseases which are capable of being adequately controlled without it, typing individuals would not have to be resorted to at all. (Unfortunately, however, much of the physician's time must be occupied with diseases which to date are not well controlled.) On this basis a system of medicine could be developed which would not be too cumbersome for utility and yet would afford an opportunity for the physician to give the patient more nearly what is individually needed.

A considerable mass of information on specific diseases is already available which might aid in the discovery of individual human types. To type diseases such as pneumonia, in which various strains of pneumococci are involved, is different from typing the individuals who may contract it. When the causative agents are not known and hence perhaps are of unitary character, typing of diseases may in essence be the same as typing the afflicted individuals.

Many attempts have been made to classify human beings in physical make-up, body dimensions, etc., and in psychological characteristics. Also serious attempts have been made to correlate physical and psychical traits. The possible correlation of physique and intellect has been explored with comparative thoroughness, and while there are doubtless relationships they are far from being simple or clear-cut. As for finding gross relationships, there would seem to be, a priori, little encouragement. Why should we expect to find, for example, one's ability to memorize rote material to be related to the size of one's foot or the curvature of one's abdomen? On the basis of a thoroughgoing analysis of all the biochemical, physiological, and psychological traits of individuals, no typing has ever been attempted, because the analyses themselves have never been made. From the standpoint of medical practice, a broad typing of universal scope including necessarily a large number of types would seem to be far less serviceable than a typing based upon specific types of disease, or upon different types of organ physiology.

The need for more extensive and more intensive medical research, which we have stressed, is based partly upon the necessity of learning more about individuals so that they can be adequately typed. Such typing, which may be done for various specific purposes, must be based upon a substantial amount of thoroughly scientific information. The development of adequate bases for typing will entail much research and no one can guess how far it may go.

At the outset the number of types recognized in connection with some diseases may be small, possibly only two, but as research in individual differences advances and more refined observations are

made the number of types will increase. As indicated by Draper and co-workers, there is now a strong tendency to formulate a text-book picture of a disease, which is equivalent to regarding everyone as belonging to the same type.

One of the lines of research which we may envisage for the future will involve the use of drugs designed not necessarily for the cure of disease but for developing means of typing individuals. We have already indicated that in the study and selection of drugs for medicinal use there has naturally been a consistent elimination of all those which tend to give highly erratic responses when administered to different individuals. Drugs have been retained that give *relatively* uniform responses. For usefulness in typing it seems reasonable to suppose that the kind of drugs which give erratic results when administered to different individuals will be more valuable. In the future attention may be given to finding drugs which, when administered to members of a group, will give the widest possible variance in results.

The question may arise in the minds of physicians whether recognizing and paying attention to individual differences will tend to develop on the part of the patient too much concern for his individual health, after the manner of hypochondriacs. It seems likely, on the contrary, that an intelligent understanding of the existence of individual differences may serve to put many people at ease, and that because they recognize the existence of individual quirks they will not be so inclined to run to the doctor with every trifling twinge of pain or physiological vagary.

Fundamentally the question may resolve itself into the relative merits of living in darkness and in light. Partial truths are often dangerous but it is difficult to see how, in the end, people can be otherwise than helped by having access to fuller truth about themselves.

XIV. Heredity and Environment

'Tis education forms the common mind,
Just as the twig is bent the tree's inclined.
ALEXANDER POPE

(But a peach tree is never inclined to be an oak.)
ANON

EXTREME POSITIONS on the relative importance of heredity and environment in human life are those taken by A. E. Wiggam and J. B. Watson respectively and cited by Allport.[1]

Nearly all the happiness and nearly all the misery of the world are due, not to environment, but to heredity:—the differences among men are, in the main, due to differences in the germ cells from which they are born.—A. E. WIGGAM.*

Give me a dozen healthy infants well formed, and my own specified world to bring them up in and I'll guarantee to take any one at random and train him to become any kind of specialist I might select—doctor, lawyer, artist, merchant, chief, and yes, even beggar-man and thief, regardless of talents, peculiarities, tendencies, abilities, vocations and race of his ancestors. . . . There is no such thing as inheritance of capacity, talent, temperament, mental constitution and characteristics.—J. B. WATSON.†

These diametrically opposite statements cannot both be true. In fact, they were written over twenty years ago, and no reasonably well informed person today could accept either of them. The truth unquestionably lies somewhere between these extremes.

* From *The New Decalogue of Science,* by Albert Edward Wiggam, copyright 1923, used by special permission of the Publishers, The Bobbs-Merrill Company.

† From *Behaviorism,* by J. B. Watson, copyright revised edition 1930, used by special permission of the Publishers, W. W. Norton and Company, Inc.

In discussion of this topic it is often pointed out that both heredity and environment are inseparably intertwined in the development of a human being. For example, if the fertilized egg which constitutes the starting point of every human individual is left without a suitable environment, requiring as it does nutrition, suitable temperature, etc., it promptly dies and no development whatever takes place. On the other hand, if a suitable environment is provided—with everything exactly as it should be—and no fertilized egg with a hereditary background is provided, again no development takes place. Because of this mutual interdependence between these two factors, some have been inclined to say in effect, "Let's forget about this fruitless heredity-environment problem, and devote ourselves to something else."

To the academic mind this may be a satisfying solution, but from the practical standpoint of human affairs this is still a highly important question—not whether one can work without the other but to what extent each contributes.

Let us suppose, as an example, that we consider again the development of a tiny embryonic human being in the mother's womb. Obviously if it had an environment entirely unsuitable, the embryo could not develop. But how much control, practically, can be exercised over the development of the embryo by changing its environment? Can we, by supplying the mother with the very best possible assortment of food elements and guarding her from all unfavorable influences, make the developing embryo grow into a child of superb physique and mentality? If this were so, this would be a wonderful opportunity to improve the human race; we should devote ourselves assiduously to the care of pregnant women; the welfare of others would be of negligible importance, by comparison. But if what happens to the mother has little effect on the developing baby, so long as she is fed and cared for in the traditional manner, then society has no reason to be especially concerned about pregnant women.

Actually we have what we think is a reasonable working knowl-

edge of how to proceed. We are quite sure that geniuses cannot be produced at will by proper care of the mother. On the other hand we do know that feeding the pregnant mother properly is of importance, and that various dietary deficiencies may cause difficulty not only with the child but with the mother. Even so, our knowledge as to how to do it, or how far we can go toward improving babies by attention to maternal nutrition, is sketchy and when we pay heed to the problem we do so mostly in order to play safe, if possible.

The problem of prenatal nutrition is not for extended discussion here; we wish only to use it as an illustration of how the problem of heredity and environment is important. Society's practical interest in the care and feeding of pregnant mothers, insofar as it has such interest, should not be based upon vague opinions but upon factual information. Whether this interest is great or small should depend upon whether the controllable factors in the environment have a great or small effect on the developing embryos.

In the nutrition of children also, and the extent to which it may control their lives, the question of heredity and environment enters in a practical way. If we can do much by proper nutrition, then nutrition should receive a commensurate amount of attention; if we can do little, its importance diminishes.

So we might go through a large number of quandaries. If idiots are idiots at birth, the problem they present takes on one aspect; if controllable environmental influences produce them, it is quite a different one. If insanity is hereditary, the issue is one thing and it is another if insanity results from the controllable environment and still a third if the origin is mixed. Suppose criminals are born: we should use sterilization measures, if feasible, to eliminate them; but if environmental influences produce them we should look after these influences; if criminals are both born and made, then we should pay attention to both factors.

In whatever direction we turn, the problem of the contributions of heredity and controllable environment is important. All our

attempts to make progress and improve society depend on our knowledge of how heredity and environment contribute to each of the questions that confront us.

While we have much scientific knowledge bearing on the problem of heredity and environment, from the standpoint of social engineering we often lack the very knowledge that we need. But we must go ahead anyway; if we don't know the facts on which to base our attempts we can assume that we know them, and this is very often done.

It is one of the larger tasks of humanics to give us more clear-cut and valid ideas as to what is heritable and what is not, and to teach us more fully and more definitely what environmental influences can do. Whether Watson's statement is more nearly correct than Wiggam's, or vice versa, makes a tremendous difference in our lives, and all attempts to improve society must hinge upon the scientific facts, whatever they are.

2

Let us first consider some of the universally accepted facts of heredity, leaving out as far as possible theories and interpretations which are not essential to broad understanding of these facts.

Heredity in mammals, and specifically in man, is exceedingly complex in comparison with heredity in fruit flies and other simpler forms which have been studied far more extensively. In view of the tremendous difference in generation time and the fact that genetic experiments with human beings would be almost out of the question anyhow, it is unavoidable that most of our detailed knowledge of the workings of heredity should be derived from experiments with simpler forms. The general principles are so adequately confirmed, however, by experiments with numerous diverse plant and animal forms, coupled with observational study of human heredity, that no one can doubt their validity. The problems of genetics, however, as they apply to simpler forms, are by no means completely

cleared up and a comprehensive picture of the detailed working of human heredity (or that of any other mammals) remains for the far-distant future.

We inherit from our ancestors a multitude of distinct, separate tendencies and abilities which through interaction with the environment become what we recognize as anatomical features, characters and traits. Sometimes the environmental influences are so highly constant that almost invariably the same character is formed. We often speak of inheriting red hair or brown eyes for this reason —what we actually inherit, however, is the *mechanism* which in the normal course of events produces red hair or brown eyes.

Speaking in the less exact manner, we shall discuss briefly some of the characteristics which every student of the subject recognizes as being inherited—in the sense that the mechanism is inherited. The first set of characteristics which may well claim our attention are those which have to do with bodily form. It is common knowledge that we inherit our anatomical make-up from our forebears; this becomes most notable with respect to facial features. These are distinctive for each of us, but a specific feature often shows a marked resemblance to a parent or grandparent. Always they derive their form from the features of forebears. If we were in the habit of observing hands or feet closely, we would find family resemblances there in exactly the same way.

An obvious fact is that we do not always inherit characteristics that are observable in our parents. Every parent is the carrier of traits which he himself does not possess, and traits which we obtain by inheritance may in some cases have been carried (without manifesting their presence) for several generations. Thus when someone is moved to exclaim, "Where did the child get that nose?" or "How can he be so tall when his father and mother are short?", the observed phenomenon is not out of line with what we know about heredity.

A large proportion of the traits which each of us shows are traits which one or the other of our parents also show. But some of the traits that we individually possess were hidden or recessive in our

parents and hence not observable in them; to find their origin we would have to go back to grandparents or to earlier generations.

When we say we inherit our bodily form, this does not mean gross features alone but minute details as well. Evidence that even fingerprints are inherited is the fact that identical twins (those arising from one egg and having therefore the same inheritance) have fingerprints that are virtually the same, whereas all other people (each with a distinctive inheritance) have fingerprints that differ one from another.

That we inherit the minute details of our anatomical make-up is a matter of far-reaching significance. Not only is the texture of our skin, its tendency to freckle or tan, and so on, inherited, but the characteristics of the mucous membranes in our respiratory tracts are also inherited, and this means that we inherit differences in our abilities to withstand the invasion of microorganisms or other parasites which attack us through the skin or through mucous membranes. Skins differ in their tendency to blister, and that this characteristic is inherited is amply demonstrated by extensive studies on the inheritance of a peculiar disease involving the very ready formation of foot blisters. Going below the skin surface to the blood vessels we find, as we would expect, that the strength of the blood vessel walls shows variation. This again is an inheritance as has been shown by the heritability of tendency toward nosebleed.

Actually every tiny anatomical feature that we possess must have as a hereditary basis a similar feature in one of our forebears. Therefore the distinctive characteristics of our individual endocrine glands are inherited. This is well illustrated by the pancreas which in some individuals is deficient, or becomes deficient at some time in life, in the production of its hormone. This tendency is inherited and when it becomes manifest we call it diabetes.

The bony structures are by no means exempt and numerous irregularities or abnormalities of bone and teeth structures are known to be inherited.

We have in previous chapters indicated some of the ways in which nervous tissues and sense organs differ from individual to

individual and how at least some of these differences are known to be inherited, and the same thing has been found of many nervous conditions in men and in animals. Emphasizing the fact that a tendency, rather than a ready-made trait, is inherited, is the case of Huntington's chorea, which produces uncontrollable muscular movements and mental degeneration; although it does not appear until middle life it is an inherited disease—that is, the faulty mechanism which gives rise to it in middle life is inherited.

Inheritance not only affects gross structures and microscopic structures but even extends to the submicroscopic chemical make-up. The heritability of blood groups, which involve differences in the chemical composition of blood constituents, has been mentioned. Hemophilia, a condition involving a faulty mechanism for blood coagulation, has been thoroughly studied and its heritability established beyond question.

Finally we come to the various metabolic conditions—albinism, alcaptonuria, phenyl ketonuria, etc.—which are known to be transmitted by inheritance from one generation to the next—a fact which is a clear indication that all our metabolic processes are inherited. Given the proper food and environmental conditions, our bodies are able to produce large numbers of catalysts, which enter into promoting and controlling the numerous chemical transformations essential to our lives. The mechanisms which make possible the production of these catalysts are all inherited—otherwise we wouldn't have the mechanisms. The metabolic deficiencies referred to above are simply cases in which parts of certain mechanisms are missing from the inheritance.

When we consider the possible heritability or non-heritability of psychological traits and abilities we are dealing with a more difficult problem and one on which we have less definite information.

In general environment is required to translate an inheritance into a trait or observable characteristic; closely related to this is the fact that inheritance of a particular characteristic does not insure us the possession of it. We may inherit the mechanisms necessary for the growing of an excellent set of teeth, but if our nutrition is faulty

in one of several ways—in calcium, phosphorus, vitamin D or vitamin C, for example—the result will be faulty teeth.

In the production of psychological traits the same principles supposedly apply. An individual may inherit all of the elements which go to make up what we will call a good disposition. If, however, poor nutrition, an unfortunate psychological atmosphere, and a failure to learn the rudiments of mental hygiene intervene, the good disposition may go to pot.

Our knowledge of what environmental factors are most dangerous and to what extent personalities are threatened or harmed by unfavorable environments is far more limited and open to dispute than it would be if we paid serious attention to the scientific study of individuals. We sometimes mislead ourselves into saying: This psychological influence reasonably *may* do so and so, therefore this influence *does* so and so. We need to know rather than to guess.

The importance of inheritance in various types of mental abilities can hardly be doubted on the basis of recent investigations involving identical twins but an extension of our knowledge is desirable.[2] For the development of mathematical ability, an extreme environmentalist might suggest surrounding an infant with all sorts of devices that would cultivate number concepts, and might advise having numbers instead of letters served in the alphabet soup. I believe, however, that most of my readers will agree that all such devices would have little effect on a non-mathematically inclined person.

If we consider one of the so-called idiot-savants, an imbecile boy of twelve years who could mentally multiply any three-digit number by any other three-digit number with lightning rapidity, we are led to think that his ability arose through inheritance and that special environmental influences (other than food, shelter, etc.) had very little to do with it.

Obviously if we want to know more about the inheritance or non-inheritance of mental abilities and mental traits, we must be able to recognize and measure the traits and abilities at least in a rough way. Most of us do not know what traits we possess, let alone

whether we inherited them (or didn't) from our paternal grandmother or maternal grandfather.

The subject of the inheritance of musical ability has been discussed numerous times. Unfortunately, however, information has been lacking on possession of the various musical abilities by individuals and their progenitors. As was made clear in an earlier chapter there are several elements involved in musical ability such as sense of timing, sense of pitch, sense of consonance; probably not all of the elements are fully recognized. According to what we know about heredity, these are inherited, if at all, not all together but each by itself. On the basis of present knowledge, the inheritance of the elementary musical abilities is strongly indicated and this is in keeping with the fact that the anatomical structures in the ear and the nervous system must also be inherited.

Of course to bring any special ability to fruition, and to make the most of it, special environmental influences are necessary, though these influences may be sought out by the individual himself. A potentially great mathematician would hardly thrive or develop without contact with others who are mathematically inclined; neither would a potentially great musician develop to the fullest extent without contact with other musicians. If the drive as well as the ability exists, however, the individual may overcome great obstacles in his attempts to find a suitable environment for himself.

We may conclude our discussion of the inheritance of psychological traits by giving the opinion that the primary mental abilities (whatever they are) are inherited and that special environmental influences probably play a very secondary role in their development. More definite information on this is desirable. With respect to the other traits—such as dominance, extroversion, altruism, persistence, expansiveness—these are probably both inherited and developed. An individual's inheritance probably may have a good deal to do with making it easy for him to develop dominance, or easy to be submissive, as the case may be. The environmental influences may conceivably play a leading role, however, and cause an individual who is by inheritance inclined toward dominance, to become submissive.

The role of inheritance and environment in producing such traits is largely speculative because of our lack of reliable information.

3

General observation tells us that the environmental conditions in which an individual is reared determine the language he will speak, the customs he will adhere to, and to a large extent the loyalties and attitudes which he will entertain.

If we imagine an occidental child adopted into a Chinese home, for example, there is no question but that the infant will learn to speak Chinese, will adopt Chinese customs, and will develop in general a Chinese attitude toward life, provided of course, in the latter case, that his distinctive appearance does not cause him to feel "different" and as an outsider.

But let us imagine another experiment in which a thousand English babies, for example, are allowed to absorb independently the same Chinese culture, and then when they reach maturity are moved to a desert island to live together. Knowing only the Chinese culture, will they cling to it or will there be a consistent modification of the Chinese culture so as to fit better the physiological and psychological traits of the English-born people?

While the question has apparently never been carefully investigated, it appears certain from the undoubted inheritance of anatomical features in the mouth, vocal cords, nasal passages, tongue musculature, etc., that language modifications and language differences have in part an anatomical and physiological basis. Would it not be reasonable to suppose, in the hypothetical case under consideration, that the language would be modified, at least within a few generations, better to suit the people using it? Would we not expect all customs to be gradually modified so as to be more adapted physiologically and psychologically to the traits of the people?

This is another way of pointing out the probability that many items of a given culture may have a hereditary basis, and many

customs may be based upon characteristic traits possessed in common by people of the same tribe or cultural group. An outsider when absorbed into a foreign culture may seem to adopt it readily (he has no alternative) but the foreign culture may still be foreign to him physiologically and psychologically. It may be quite a different type of culture from any that his kind of people would ever have developed.

The situations here described are admittedly imaginary and the results speculative. They do have a bearing, however, upon many anthropological investigations and their interpretation. If I understand, for example, the extensive studies made by Margaret Mead of the Arapesh, Mundugumor and the Tchambuli tribes in New Guinea, there is a tendency to *assume* that the striking differences in the cultures of these tribes is environmentally produced. For example, the Arapesh children grow up to be docile, contented and unaggressive because of determinative factors in early training, such as the fact that they are fondled and are allowed to dawdle and dally in their nursing. But the cannibal Mundugumors are said to grow up to be aggressive because they must "fight even for their first drops of milk." [3]

An alternative explanation is that the Arapesh are by natural inheritance docile and unaggressive; and this is why they treat their children as they do. Possibly the Mundugumors are by natural inheritance aggressive and competitive, and it is for this reason their children receive a different type of treatment.

It is indicated that "the twin birth rate [of the Mundugumors] is far in excess of that for any of the other known tribes of that part of New Guinea." The existence of this heritable trait within the tribe indicates that inbreeding has taken place, and makes very plausible the suggestion that one tribe differs from another because of inherent traits.

I am not proposing, however, that Dr. Mead's interpretation (assuming that I understand it) be discarded and the alternative explanation accepted. Rather I wish to emphasize that the question is not settled, and by its nature cannot be until we make a more

intensive study of individuals. While the importance of environmental influences cannot seriously be doubted, the evidence on which the idea is based is often of a most unsatisfactory nature.

An unconvincing line of evidence is that relating to children who have been reared in the wild and who have shown the effects of the lack of culture when they have been returned to civilization. Cases of this sort have been reported for hundreds of years, usually, however, on the basis of non-scientific and uncritical observations. One of the most recent and widely cited examples is that of the "wolf children" of India.

These children were first observed (other than by natives) in October, 1920, through field glasses at a distance of a hundred yards. Six years after the event, the Reverend Singh, who eventually adopted the children, wrote the following description in a letter:

> Three wolves were observed to come out of a tunnel-like passage from their den, closely followed by two cubs; then there appeared a human head covered with bushy hair with a ghastly look about the face. This head tarried for a little while looking to this side and that side, then a human form came out of the den followed by another human being at its heels. The two children crawled on all fours.

The children were judged to be about two and eight years old respectively when they were adopted. The younger died in a few months but the older, named Kamala, was alive and with the family at the time the letter mentioned above was written in 1926. After six years in the civilized home she was able to utter about forty words including a few sentences of not more than two or three words. Originally she ate like an animal but learned somewhat more refined methods. She was able to walk straight on both legs but could not run at all. She never had been housebroken and would answer the call of nature anywhere and at any time.[4]

In Arnold Gesell's reconstruction of the life history of the older girl, Kamala, he obviously and admittedly called upon imagination and invention to fill in important gaps in actual knowledge. He understates the condition of ignorance regarding her early life when he says, "We do not even know when she was captured by

her foster mother wolf." Actually it isn't known that she was *captured* by a wolf at all, and the foster mother relationship is hazy especially since there were two children differing in age by six years.

In spite of the fact that he estimated her mental age at three and a half years when her chronological age was about seventeen, Gesell expresses the opinion that she was not innately mentally deficient. He accounts for her retardation solely on the basis of her early years in the wolf den. This is the crucial question in the whole study. If she was normal at the start, her life story is most interesting; if she was mentally deficient, the story loses at least nine-tenths of its interest. To the present writer it seems unlikely that a healthy and intelligent child could be so warped by wolfish associations of eight(?) years' duration that she should be unable to learn in six more years what a puppy (or even a wolf puppy?) may learn in a few weeks. There is certainly no *proof* that the girl Kamala was not feeble-minded from the start.[5]

No one who critically examines the evidence regarding the so-called feral children can feel that it is completely conclusive or that the question is in any sense a closed one. Examples such as the wolf children in which the heredity of the individuals is wholly unknown can contribute little to our critical knowledge of the importance of environment. Especially so since the chances that healthy intelligent children will be abandoned or go wild are manifestly far less than are the chances of deficient children doing so.

4

The method of studying the relative effects of heredity and environment which offers the most promise involves the utilization of what are often called identical twins, particularly when such are reared apart in different environments. Such twins arise from a single egg cell and are commonly considered to have the same inheritance.

Unfortunately, however, identical twins are often not as identical as we could wish, for two general reasons; first because of differences in prenatal environment, and second because of partial asymmetry reversals to be discussed below. Since two bodies cannot occupy the same space at the same time, one of a pair of identical twins is liable to be less favorably located in the mother's womb than the other. This is particularly true for blood supply and in some cases the difference can cause one twin to be markedly underdeveloped in comparison with the other. Postnatal nutrition may tend to lessen the discrepancy.

It is not uncommon, however, for identical twins to be appreciably different in weight at birth and to maintain a similar difference throughout life. Another circumstance which may have a difference-producing effect is that one of the twins has to be born first, and the obstetrical situation is not identical for the two.

The asymmetry differences are interesting and probably of importance. Sometimes identical twins are born who are almost perfect mirror images of each other—that is, one is right-handed while the other is left-handed; one has a clockwise whorl in his hair, the other a counterclockwise whorl; if the right ear of one has a slight irregularity in shape, the left ear of the other is affected in a similar manner, etc. If this situation should exist throughout the whole body then one twin would truly be the mirror image of the other and except for this asymmetry they would be identical. Complete mirror-imaging is, however, rare; in fact, both twins are more often right-handed and appear to be more nearly duplicates than mirror images. In most cases, however, there is partial mirror-imaging and partial duplication. In this sense the twins fail to be identical, and this difference may be at the basis of physiological and psychological differences.

In organic chemistry we have a somewhat comparable situation. When two kinds of molecules are structurally mirror images of each other, they are called antipodes, and always have identical solubilities, reactivities and energy content. When two molecules are partially mirror images and partially duplicates, then the compounds

are called diastereoisomers. While they are similar, they do not have identical solubilities, reactivities or energy content.

The most intensive study of the heredity and environment problem using twins as a basis is that of Newman, Freeman and Holzinger.[6] They first studied fifty pairs of identical twins who had been reared together and for comparison fifty pairs of ordinary (fraternal) twins. Fraternal twins come from separate egg cells and are therefore as much unlike as ordinary brothers and sisters. One of the more important findings was that even when identical twins were reared together under surroundings which were identical (insofar as it would be possible for society to make them so) they were "never truly identical" and sometimes differed "to a disconcerting degree." A comparison of older pairs of twins with younger ones indicated "a slight but hardly significant tendency for the older twins to be less alike" as indicated by mental and educational tests. This is interpreted to mean that differences due to environment which would tend to increase with age had at most a slight effect in causing the individuals to become different.

A study was also made of nineteen pairs of identical twins who had been separated in infancy and hence had been subjected to different environmental influences. A comparison was made between the differences exhibited by these identical twins and those reared together. In "weight, intelligence, and school achievement" the separated twins showed significantly greater differences than did the unseparated twins. The greater differences in weight (of the separated twins) can well be attributed to differences in nutrition; the differences in rated intelligence are probably associated with increased schooling. We have previously commented upon the limitations of intelligence tests in measuring mental ability.

The extensive study just cited leaves largely unanswered the question as to the extent to which physiological and psychological traits may be modified by environmental influences, though in connection with the intelligence and school achievement tests the authors state: "Some slight change is also suggested in the case of temperament." This study was planned nearly twenty years ago and

had to be carried through largely on the basis of tools and techniques available at that time; Thurstone's exploration of primary mental abilities, for example, came after it had been completed.

We have previously indicated that the full searchlight of science has never been thrown upon any individual human being. In the chapter on marriage we noted that no married couple had ever been investigated with scientific thoroughness. Again in connection with the present subject we can say that no pair of twins, identical or otherwise, has ever been subjected to a thorough study from all the angles that offer promise.

In the earlier chapters we outlined numerous differences which commonly exist among human beings: metabolic differences, differences in reactions to drugs, several vision differences, numerous other sensory differences, reactions to temperature and sleep, electrical phenomena, endocrine patterns, mental abilities and other psychological traits. If identical and other twins were studied at different ages from all these angles we would be very much nearer knowing the facts with regard to the contributions of heredity and environment to human life. The possibilities of improving society depend upon our knowing the relative importance of various factors in our lives, and when we build merely upon assumed knowledge we are building upon an insecure foundation.

In some circles there is a tendency to attempt to trace all sorts of unfortunate psychological attitudes on the part of adults to important but seemingly inconsequential events which took place in very early childhood. We should have more definite information, as opposed to speculation, on such phenomena. One word may be said against the possible exaggeration of these effects. From what we know about the ability of young children to recover from all sorts of bodily injuries without permanent impairment of their faculties it would seem that trifling psychological injuries should not have lifelong effect. Probably psychological injuries are more likely to result from permanent wrong attitudes on the part of parents and other members of the family. This is one reason why it is so essential that people understand better how widely and in

what numerous ways individuals differ from one another. With this knowledge, it should be possible to lessen the psychological damage that we inflict on each other, regardless of whether we imagine the possibilities of such damage to be relatively small or tremendously large.

XV. Humanics and Leadership

When a blind man flourisheth the banner,
woe be to those who follow him.
FULLER'S *Gnomologia*

THERE ARE TWO WAYS in which humanics can contribute to the problem of leadership as it occurs in the numerous ramifications of human society: in improving the selection of leaders and in the prevention of abuses.

We shall assume that leadership is inescapable and that it makes for efficiency in the pursuit of common purposes. Its existence presupposes followers—not blind and irresponsible individuals who have no minds of their own, but individuals who are able for the common good to follow some strong individual who has purposes like their own. As Pigors says, "Followers subordinate themselves, not because the leader is utterly different but because he is *the same,* only more so."[1]

2

Certainly one of the serious shortcomings of social organization in general has been the elevation of misfits and the creation of abuses in leadership. We may think of ourselves as living in an age of science, but with regard to choosing leaders we depend at best largely upon empiricism. Often our choice of individuals to lead in important ventures is hardly more intelligent than it would be if names were drawn from a hat.

One of the fundamental reasons for our frequent and often disastrous mistakes is that we have never paid serious attention to the study of individual men and women and to the measuring of their capabilities and characteristics. Probably we have progressed somewhat since the day when William Jennings Bryan became for many years the leader of an important political party primarily because he coined a catch phrase and possessed a fluent tongue, but we still choose our political leaders because of their good radio voices and when television becomes common the radiance of the candidate's smile may be an important determining factor.

It is true that professors behind cloistered walls have studied the psychology of individual differences but whatever they have learned has made relatively little impression on the public. It seems to me that one of the serious drawbacks to the public acceptance of psychological measures is the failure on the part of many psychological testers to recognize the importance of a *series of mental abilities of several types,* and their unfortunate tendency to lump all these abilities together and assign to individuals intelligence quotients.

What does the public know or what has it cared to know about the intelligence quotients of Franklin D. Roosevelt, Wendell Willkie, Thomas Dewey or Harry S. Truman? Is the public's complete indifference to this information an indifference to the intelligence of our political leaders? I think not. If the public thought intelligence quotients were significant measures of intelligence and practical sense, it would sincerely desire to know the intelligence ratings of its potential political leaders. But the public knows from long experience and observation that sometimes professors (who must have high I.Q.'s) are "dopes," and that untutored folk (who probably have low I.Q.'s) often have superior judgment and good sense.

Our superficiality in the study of individual human beings is bearing fruit that makes our mouths pucker. The public takes little stock in our I.Q.'s and never even stops to ask the psychologist how intelligent a potential leader is.

I take the position that it would be desirable to know a great deal about the mental abilities and the psychological traits of anyone

whom we put in a position of leadership. But the information must be trustworthy and significant, and based upon a more thorough knowledge than we now have. This is surely one place in the field of social relations where more science is needed.

There are doubtless many psychological characteristics which help to determine whether a person will be a successful leader in a specific undertaking and it often happens that a more or less chance selection turns out to be a wise one. Some people with meager experience when suddenly placed in a position of responsibility measure up remarkably well, but it is a gamble.

One of the highly important factors is the individual's attitude toward the public and toward the job to be done. If he secretly suffers from the effects of bad mental hygiene, has a feeling of inferiority such that his own personal fortunes are ever the center of his thought and attention, then the public has a right to know about these difficulties, just as it would if he were blind or deaf. Faked amnesia or faked blindness can be detected by electroencephalographic study. If the resources of science are called upon, it is not at all unreasonable to think that faked public interest and faked honesty of purpose could also be detected by suitable means. When scientific study has advanced to the point where the methods work with high consistency, it is probable that lie detector techniques will be applied to individuals who propose to assume leadership, to determine whether they are actually suitable leaders or are merely pretending to be.

Some people will shrink from the thought of subjecting a candidate for leadership or public office to a critical examination, because of undue invasion of his privacy. But the candidate isn't compelled to run for office and it would be as fair for one candidate as another. When we become educated to its possibilities, we will think nothing of having a candidate's head examined by encephalography or by any other means that will reveal his suitability. Even giving him a harmless drug which will enable the public to find out the truth about his immediate attitudes may be some day looked upon as a

commonplace precaution. The reader may be reminded that the public's ideas do change radically. Street lighting was once condemned on the ground that if the Creator had intended it to be light at night, suitable arrangements would have been provided (possibly by more and larger moons).

In order to be able to select leaders with the highest degree of success, it will be necessary to have more definite ideas as to what makes for leadership. The whole personality, including the physiological and psychological traits, should be studied in the case of individuals who have been conspicuously successful as leaders, in order that we may know better what successful leaders are like.

The scientific point of view needs to be developed in this field. Too often we read history without conceiving the possibility that something could be done to prevent it from repeating itself. We do not look, for example, upon the rise and ascendancy of Francia (*El Supremo*), the Paraguayan dictator (c. 1757-1840), as a scientific phenomenon to be investigated and understood. This remarkable man gained his power largely by peaceful means, governed his country as a despot for many years, held it aloof from all international relationships, lived past eighty and died a natural death while he was still in power. And yet we know little about what made him so successful. We know that his country after winning its independence was in such a condition as to give a potential dictator a chance, but Francia's qualifications for the job or the qualifications of dictators who have followed him in other countries have never been successfully analyzed. It made a great difference to Paraguay, *who* turned out to be dictator, and the history of the world is obviously greatly influenced not only by whether or not a dictator is chosen, but also by who takes the post.

There are two obvious ways in which scientific study can be directed toward this problem; one involves studying successful leaders (including dictators who dominate rather than lead), and the other involves studying leadership and domination among animals.

In many cases where animals live together in groups a hierarchy

of dominance is established. A study of dominance in ordinary barnyard fowls was initiated by the Norwegian Schjelderup-Ebbe over twenty years ago and has been illuminating. Close observance of hens living together in confinement shows that a fixed peck order is established in the group, whereby each hen comes to know her place whether she be highest, lowest or intermediate in dominance. In general there is one hen that can peck any hen in the group and get away with it, and at the other end of the scale there is a hen that any other member of the flock can dominate. Not always is the order rigidly established in numerical sequence. Sometimes number five hen, for example, will maintain this general position in the flock and yet be able to dominate hen number three.[2]

Many kinds of birds have been studied as well as other animals including monkeys in the London Zoo. Interesting hierarchies have been found to be present as a rule. When groups of hens are involved, an established order is soon developed and the social situation becomes relatively static. If cockerels are placed together the situation remains badly mixed up, many fights take place, more dominant birds tend to become demoted, less dominant birds rise (as well as fall), and no bird may be able to maintain consistent domination.

With pigeons and several other species of birds we find significant differences. In the first place, in contrast to chickens, groups of male pigeons behave about the same as groups of female pigeons. Neither males nor females develop as fixed a peck order; in fact, while some pigeons appear to be definitely more dominant than others there is no completely dominant pigeon and there may be reversals of dominance from time to time in the absence of unusual circumstances. The differences between various species in their tendency to form a well stratified society suggests that different races of mankind may show the same type of variance as a result of innate traits.

Birds and other animals may show dominance when they are in home territory and may lose it in strange surroundings. A dominant hen in a flock may lose her position as the result of prolonged absence, or if hens which are kept in a small pen are turned out to

roam over new territory their order is liable to become modified as a result.

Investigations in this field, which may be highly revealing from the standpoint of human social problems, have been carried out by only a few investigators who have had limited public support.

Of particular note from the standpoint of our discussion is our failure to tackle seriously the problem of what is the secret of leadership even among animals. We have not devoted ourselves to studying individuals either among animals or among human beings, hence we are relatively in the dark as to the attributes of a dominant hen, a dominant pigeon, a dominant monkey or a dominant Hitler.

Seniority, fighting or bluffing ability, good health and aggressiveness are among the factors which determine dominance in fowls. Size is not important. That the endocrine secretions play a part is indicated by changes in dominance during brooding periods; also by direct experiments the injection of sex hormones has been shown to influence dominance. Among fowls the males commonly dominate the females but among other birds the reverse may be true. The effect of nutrition on dominance has scarcely been investigated, though it is known that poor nutrition in general causes lowered dominance.

The problem of leadership and domination is a complicated one —especially so among human beings. But certainly one way of studying human society is through an attempt to understand more about animal society. If we cannot understand animal society, which is relatively simple, we are in a poor position to appreciate the intricacies of human society. A large part of what we know about man, his body, the functioning of his organs, his nutrition and his medical treatment was learned by studying animals. Is there any good reason to suppose that the study of animals may not prove just as fruitful in the social field?

3

One of the inevitable results of a knowledge of human beings, I believe, will be an appreciation of the fact that no man is by nature equipped to be *the* leader in every avenue of life.

If intelligence quotients meant what the name implies it might seem the sensible course to select the most intelligent man in our country, make him President and keep him in office as long as he remained the most intelligent. But since we cannot scientifically be rated as smart, smarter and smartest, but only for specific types of mental abilities, such a proposal is ridiculous. There are numerous ways in which it is possible to be intellectually able and no one excels in all. When we consider the numerous traits and abilities that individuals may possess in varying degrees, and recognize that when one trait is up another is liable to be down, the idea of allowing one man to be dictator with power to make decisions on all activities of life is wholly absurd.

Society needs leaders badly; leaders in industry, in science, education, government, journalism, law, in engineering and medicine, in religion, in music and art and in entertainment and in sports and every other line of human activity. But it doesn't need universal leaders—those who lead, or rather dominate, in every field. No one is able to qualify for such leadership.

Actually dictatorships and unwarranted dominance by individuals arise partly because of our general ignorance of individual limitations. When a human being shows unusual prowess or ability along one line, and thus possibly qualifies for leadership in that field, we can often be led to imagine that these abilities carry over into other fields. If the individual keeps his vocal cords relaxed and quiescent at the proper times he may create the illusion of possessing breadth of vision far beyond his actual horizon. The abuse of power has often come about in this fashion—the individual demonstrates some special ability, often as a maker of speeches, whereupon other vir-

tues and abilities are showered upon him and gradually he becomes an authority and finally *the* authority on all subjects. A better knowledge of the nature of human abilities and of human frailties would prevent this from ever happening. It is difficult to imagine a dictatorship arising in a country well informed about the attributes of individual human beings.

XVI. Humanics and Employment

Far and away the best prize that life offers is the chance to work hard at work worth doing.

THEODORE ROOSEVELT

THE EXPLORATION OF OURSELVES not only has many potentialities in connection with physical and mental health, education, marriage and social organization generally, but also has inexhaustible possibilities related to employment.

We may broadly state two problems of employment as consisting of (1) the need for *more* employment, and (2) the need for *better* employment. Human exploration can contribute substantially to the solution of the first and in an outstanding way to the second. Progress in the provision of better employment will be accompanied by increased employment in the field of human exploration itself.

2

In this book numerous reasons for intensive study of human beings have been suggested. When we consider the numerous forms of activity that will be served and the vast study required, we may be almost overwhelmed by the question "Who is going to carry on this vast enterprise?"

The answer is that in human exploration we have a new frontier, the basis for new professions, the foundations of a giant new industry, if you will. Without going very deep into economics we

may consult our dictionary to find that an industry is "Any department or branch of art, occupation or business, especially one which employs much labor and capital and is a distinct branch of trade."

Humanics, as it will develop, will fall into the category of an industry because labor and capital will be involved in the production of a special type of valuable service. Will not young men and women be happy to pay handsomely (in installments if necessary) for a practical and serviceable analysis of their capabilities and traits? Such analyses will have to be the "real thing," and as such they will be of immeasurable help in the selection of an agreeable lifework and in the selection of a mate, in addition to contributing greatly to physical and mental health.

Humanics may be regarded as a home industry, too, because whatever outside services may become available, an individual will surely gain self-knowledge from his family. More important still he must study himself and learn to make his own decisions.

Humanics will be a school industry, also, and any school that does not contribute materially to an individual's knowledge of himself will be considered a failure. School staffs will have to be expanded to fulfill this important function. It will be impossible to carry out education even on a partially individualized basis when classes are large, and the need for additional teachers will be a basis for new and profitable employment.

This industry which we are considering cannot arise full-grown overnight simply because the basic knowledge necessary to produce a highly acceptable product is not yet developed. It is within our grasp, but the grasping of it will entail extensive research and this involves a substantial amount of employment itself—not only for the investigators but their helpers, clerical staff, instrument makers, architects and builders and everyone who may contribute indirectly.

We often hear it stated that economies become old and relatively static when frontiers can no longer be pushed back, and when new, large-scale enterprises become impossible. In human exploration we have a new frontier which is capable of yielding fruits certainly

more valuable than bags of yellow gold dust and just as useful as fields of yellow grain.

Early in the evolution of man he was presumably much like the animals. Material needs, things to eat, to wear and to shelter him, were the commodities in his economic world; little else concerned him. As he has progressed, however, things of the mind and spirit have risen in importance, and we can look to the day when an increasing amount of man's effort and striving will be for intangible values pertaining to his mind and his emotions. Looked at from this point of view, humanics is a vast frontier, the exploration of which is both logical and irresistible.

We have by no means reached the frontiers of the natural sciences. Kettering has said, "If we could get out of our minds the idea that we know a lot about everything, and realize that the whole thing [research] is ahead of us, then we would have a shortage of labor in no time." The collaboration of physicists and chemists to produce the atomic bomb awakened people anew to the potentialities of science. Perhaps it emphasized in their minds too much the potentialities of destruction, rather than constructive possibilities. But natural science can construct marvelously, as well as destroy, as will be better appreciated as new peacetime wonders of science are made available to the public.

The frontiers of natural science and the frontier of human exploration are closely related and supplementary. Human exploration will have the natural sciences as its basis and the development of these sciences will be essential for exploring human beings. Conversely, a better understanding of human beings will contribute to natural science by making it possible to develop better scientists.

The day may come when in every town and city there will be business organizations composed of experts who, with the tools of natural science, will be able to determine with high success the potentialities of any and every youngster or adult who appears before them. This industry if taken seriously can be of tremendous proportions because the commodity to be sold is something that literally *everybody* will want, something that cannot be sold second-hand,

and something which can demand *and be worth* a large price. Since individuals are not unchangeable several analyses may be needed during a lifetime. Its advantages when viewed as an industry furnishing employment is that the product cannot be machine-made with interchangeable parts, but demands the consistent use of the human mind—our highest endowment. Underlying all practical uses will be continuous research in the industry and in educational institutions, in order that new triumphs may emerge.

Every new industry suffers from its frauds and charlatans and we can be sure, if only on the basis of experience with mental quacks, that this industry as it develops will not escape. It takes time for the public to become educated to recognize the difference between the spurious and the real, and there should be adequate government protection against frauds who claim too much and deliver too little and whose expertness is limited mostly to their salesmanship.

That such an industry as I have visualized has real possibilities and is not merely a visionary idea is shown by the existence and growth of the Human Engineering Laboratory of Hoboken, New Jersey, with several branches in other cities. This organization originated as a project of the General Electric Company in an attempt to improve plant morale and efficiency by applying experimental tests to fit employees into jobs where they could do their best work. Out of this has evolved a laboratory which has enlarged its purpose "from industrial efficiency to an attempt to understand ourselves better through knowing what we can do."[1]

In this laboratory, where anyone over nine years of age can be analyzed, the testing has centered around thirteen aptitudes: (1) personality [expansiveness, reclusiveness]; (2) accounting aptitude; (3) creative imagination; (4) structural visualization; (5) inductive reasoning; (6) analytical reasoning; (7) finger dexterity; (8) tweezer dexterity; (9) observation; (10) memory for design; (11) tonal memory; (12) pitch discrimination; (13) number memory. The selection of aptitudes for testing has no doubt been influenced by the previous history of the organization and some of the apti-

tudes chosen are pertinent to notably urban and industrial populations. While the analyses cannot in the nature of the case be highly scientific in all respects, nor are the conclusions drawn free from conjecture, this organization seems to be making use in a practical and effective way of the readily available scientific knowledge and at the same time searching for more insight and more worth-while tests to apply.

For a description of some of the accomplishments of this organization the reader is referred to the book *Square Pegs in Square Holes* by Margaret E. Broadley. One of the most remarkable of the incidents recorded is that of a typical bum picked up on the lower East Side in New York and sent for testing by a prominent executive as a joke. The tests revealed that the bum had what the organization thought to be the aptitudes necessary for an excellent office manager. The jester was induced to give the man a job, and four years later the bum was office manager for the executive's company. Luck may have entered to some extent into the deductions in this case but one who reads of the accomplishments of this organization will be convinced that science has been put to real use.

From the standpoint of our discussions, this work is a start in the right direction, but it is only a start. There are more crucial aptitudes than those listed and doubtless many of those considered can be more clearly defined and measured in a more scientific manner as research progresses. The industry of testing human beings for their capabilities must eventually be developed to the point where it can be done with something like scientific thoroughness. In addition to developing and refining tests, and determining their validity, the aptitudes of successful men and women in every walk of life must be determined, and, finally, instead of being applied to a few thousands of individuals this type of scientific study needs to be applied to many millions. Experience alone will determine when exhaustive tests will be necessary and when abridged studies will suffice, but the equipment to do a thorough job whenever it is called for is needed.

3

Employment can be looked upon as improved either from the standpoint of the employer or from that of the employee. The far-reaching benefits which will arise out of a more adequate knowledge of human beings will accrue to both and to the public as well.

From the employer's viewpoint there are jobs to be done, and what is most desired is efficient and dependable performance of the tasks, however complicated or however simple. If there are machines to be run operators are wanted who will be as dependable as the machines themselves; if positions require foresight and vision men or women are needed who can be depended on to possess and use these attributes.

In general the testing of employees and applicants has been concerned chiefly with routine work for which large numbers are required. The whole matter has sometimes been treated as a joke: a man hiring stenographers has been represented as devoting Mondays to the rejection of all girls with red hair, Tuesdays to ruling out blue eyes; on Wednesdays all girls with pronounced dimples are sent packing and no one is hired the rest of the week. Or an employer is pictured as looking blankly at the psychological scores of three prospective secretaries and saying, "I'll take the blue-eyed blonde."

The advances of industrial psychology have been far from meager, however. Some of the larger companies go to considerable pains and professionally trained men aid them in selection, promotion and transfers. This is to the advantage of employers, especially as unemployment insurance makes labor turnover costly and union contracts make it less easy to dismiss individuals once they have been employed.

For the choice and promotion of men and women in the higher wage brackets personal judgment is largely relied upon rather than any tests which may be given. Systematic methods of selection,

except for specific types of factory jobs, have not been worked out with enough scientific exactitude to make them generally trusted—another sign of the acute need for more intensive study of individuals and their capabilities.[2]

The scientific selection of employees who must have expertness and skill is important. The usual interviews and references lead to hiring individuals with a wide variation in performance. For some jobs of assembling or other factory operations it is common for the most efficient workers to have two or even three times the output of the least efficient, though their experience is equal. In simple tasks individual differences tend to decrease with training—the less apt and the more apt level off with about the same performance. When the work is complicated, however, individual differences tend to become greater with training, which makes it more important that those hired have the particular capabilities which are required for each specific job.

In our utilization of human material we have not reached the age of science. We are as backward as a construction engineer would be if he built with materials which had never been analyzed or had their strengths determined. Even though the progress of industrial psychology is inspiring, we have a long distance to travel, particularly in testing for difficult and important jobs. All of us can think of men in authority who should not be there, and probably know others who seem to have what it takes but never get a chance. If by eliminating the serious misfits we could use available material effectively and scientifically the benefits would be immeasurable.

4

The ideal of everyone is to have an occupation in which, with reasonable consistency, the work is enjoyable. When this goal is attained it means, in general, that the individual can do the work well; the job fits his aptitudes.

Since there are approximately 17,000 occupations in the United States no one should feel unduly limited. But to select an occupation with intelligence one should know two things: (1) what traits and abilities are required and (2) what traits and abilities one possesses. For the most part we are ignorant on both counts. Fortunately many people are so constituted that they could be relatively proficient and happy in any one of several occupations, and there are occupations in which the requirements are not highly exacting, so we muddle through somehow. Or do we?

Berrien reflects agreement with this point of view when he says with regard to personality and vocations:[3]

> Nearly everyone who has dealt with the question of vocational guidance mentions the importance of selecting an occupation into which one's personality will readily fit. The chief difficulty with this advice is that very little is known about the kinds of personalities required in various occupations. There have been very few systematic studies designed to distinguish between salesmen, foremen, business executives, bankers, physicians, and so on, in terms of emotional stability, introversion, dominance or any other personality feature. This does not mean that vocational counselors have not considered personality important. On the contrary, they talk long and glibly about personality requirements for specific vocations, but they have depended largely upon the evidence of casual observations in arriving at conclusions about the kind of personality required in any given occupation.*

When a person has a wrong job—that is, one for which his aptitudes do not fit him—his life may be upset in numerous ways. Among the calamities that may befall him are accidents.

The number of people killed and injured by accidents in this country when figured over a long range is far greater than those killed and injured in war, and there is good reason to believe that a large proportion of these accidents can be prevented only by paying attention to the causes that lie within the individuals involved.

Among automobile drivers, it is found that there are accident-

* From *Practical Psychology,* F. K. Berrien, copyright 1944, reprinted by permission The Macmillan Company.

prone individuals who are responsible for far more than their share of accidents. In one study 10 per cent of over a thousand taxicab drivers had 32 per cent of the accidents. In another study automobile drivers were rated in five groups on the basis of the number of accidents in which they were involved during a three-year period. These groupings proved to be a perfect index of the relative group records for the three years following, and the accident rate for the more accident-prone groups increased.

The same situation holds in industrial accidents. About 9000 steel workers were placed in eleven groups on the basis of whether they had paid 0, 1, 2, 3, 4, 5, 6, 7, 8, 9 or 10 visits to the plant hospital during the year. The following year the eleven groups stood in exactly the same order as before.

A thorough study of human beings such as we have advocated will be required to determine the underlying causes of these differences which are so apparent, and there is good reason to expect that it will be possible to place individuals who are prone to accidents in occupations where they will not constitute such a hazard to themselves and to their associates.

I have in mind two acquaintances, one a prominent engineer, another a prominent scientist. Of these neither can safely operate an automobile. Of the two, one simply never drives, the other has driven but has had so many accidents that he has had to give it up voluntarily. Such atypical behavior must have physiological and psychological bases, but no one knows what they are. Only a thorough study of human individuals can reveal the differences because attempts to do so on the basis of simple tests have failed.

The field of accidents is one in which a study of the peripheral vision of individuals and particularly their ability to detect movement in the peripheral field should prove valuable. We must not expect, however, that one key trait will be the complete solution to any problem. Human beings are too complex for this to be the case.

Recognition of differences and knowledge of the traits of employees will in many cases make it possible for them to obtain

working conditions—illumination, ventilation, temperature, etc.—better adapted to their needs. This will decrease the tendency toward accidents and illness and contribute to general well-being. And whatever helps the employee will help the employer to obtain and keep dependable and efficient workers.

The greatest benefit the individual can derive from having a job which suits him physiologically and psychologically is perhaps his increased morale and improvement in mental health. It is said that there are more mentally ill people in our country than those afflicted with all other diseases combined. Certainly having a job which suits one's aptitudes is of paramount importance. No one could be expected to be really well mentally unless he has an occupation which allows him to use his aptitudes.

While the evidence which can be cited is not satisfactory from a strictly scientific viewpoint, there is good reason for thinking that undeveloped aptitudes cause trouble. Many examples could be given of individuals whose mental and physical suffering has been great because they were made to do work for which they had no fitness. One of the early observations in the Human Engineering Laboratory was of a slovenly, sulky girl who was obsessed with the idea that spies were after her. Her work involved finger dexterity for which she lacked aptitude, but when her job was changed to work involving tweezer dexterity, for which she had aptitude, she lost her obsession and began practicing neatness and friendliness.

It may be considered as one of the axioms of life that healthy existence is impossible unless one's occupation furnishes a natural outlet for one's energy. This outlet cannot be a natural one unless it is in line with one's innate capabilities.

5

A study of human beings is not offered as the complete answer to the problem of employment or any other problem but as an indispensable starting point.

The whole question of employment involves many factors which

we have not mentioned. The economic and political aspects remain after one knows what aptitudes one has as well as the aptitudes required for the jobs at hand. Perhaps the available and the required aptitudes will not match up. What then? Perhaps we cannot devise an economic system in which each individual can find employment of any kind, let alone employment in keeping with his aptitudes.

Such problems cannot reasonably be regarded as insoluble until we have made more serious attempts at their solution. It is my belief that social problems, like other difficult and complex problems, cannot be solved by pecking away at the superficial aspects and neglecting such basic factors as the fundamental characteristics of the individuals who are concerned. So while a better knowledge of human beings will not of itself constitute a complete solution to employment or other social problems, no adequate solution can exist which leaves out human exploration. If we sincerely wish to apply science and scientific methods to the problems of social relations, how can we do so more effectively than to *first know ourselves?*

XVII. International Relations

Their persons being cultivated, their families were regulated. Their families being regulated, their states were rightly governed. Their states being rightly governed, the whole empire was made tranquil and happy.
CONFUCIUS

IT WILL NOT BE MY PURPOSE to mention—let alone discuss—all the factors which enter into the problem of preventing war and cultivating co-operative attitudes between nations. It will be enough to outline some of the ways in which a better knowledge of human beings can help.

We shall start with the assumption that war is undesirable and that we as human beings can ultimately prevent wars if we wish. Optimism about prevention of war is not mere indulgence in Utopian dreams; it is a common-sense attitude which we should adopt toward each specific social end that we desire. We should assume that it is within human reach, at least until we have failed in serious and consistent attempts to attain it.

If we look over our national budgets, we see a reflection of our attitudes and are caused to wonder how serious our desire for peace is. When a war is on we spend money and lives prodigiously (as we should) to get it over, but when peace comes we hope for the best, fear the worst, and concentrate on recovering from the orgy of loss and spending that we have just experienced. How much money goes into our budget for the prevention of other disasters?

Until we have made a sincere effort involving the expenditure of ample time and money we have no real basis for pessimism or belief that the goal is unattainable. We may indeed find the "moral

equivalent for war," which William James referred to, in our striving to understand ourselves better.

The suggestions which will be offered here are by no means exhaustive. They constitute some of the possibilities which are connected directly with a better knowledge of ourselves. We shall not deal with actual or hypothetical social devices or inventions which may be only distantly related to our general theme.

2

Part of what may be said on the subject of international relations has already been implied in the chapter on leadership. If the fundamental basis for choosing leaders can be clarified, if we can recognize more accurately just what their capabilities and limitations are, then the social machinery for their selection and for their functioning has a much better chance of accomplishing the ends that we desire.

While it is thrilling to us of the United States to read of the triumphs of our aircraft industry in the late war, in producing the unbelievable number of 1500 planes per day, the exploits of the men who manned these planes is more highly charged with human interest and drama. From the standpoint of future possibilities in international relations, however, it is even more inspiring to know what our psychologists were able to do in the selection of prospective fighter pilots, bomber pilots, bombardiers, navigators, aerial gunners, radar operators and flight engineers.[1]

The enormous production of over 50,000 planes a year could have all been for nothing if men to fly and operate the planes had been lacking. The selection and training of the airman was a seemingly impossible job which was nevertheless done in an outstanding fashion. Speed and lack of waste motion was essential because the production of airmen had to be geared to the production of planes; the trained personnel was limited, and ten months' training and

$30,000 in money was involved in every case. It was essential that the training click.

After a period of research into the methods to be used, individual candidates were exhaustively and exhaustingly studied through numerous carefully selected aptitude tests such as could be answered by penciled check marks, followed by electrically scored tests in which the candidate manipulated elaborate machines for determining psychomotor abilities involving equilibrium and co-ordination of senses, muscles and mind. It was found that the possession of a college degree had nothing to do with the ability to pass the tests nor did it have anything to do with flying ability. Furthermore the screening tests showed clearly that some were cut out for pilots, some for bombardiers and some for navigators and that each individual showed distinctive abilities. Most remarkable was how the tests, developed in a comparatively short time by a relatively small staff, made it possible to select fliers successfully and with precision.

Before the tests had been devised two out of every three candidates were washed out, leaving only about 33 per cent who were successful and some of these probably could not have qualified under the more stringent perfected techniques of examination adopted later. After the tests had been developed 96 out of 100 of the top scorers were commissioned. The value and essential accuracy of the tests were shown by studies of accidents and success in combat. It is said (though it is hard to believe) that the testing of the candidates cost less than five dollars a candidate. One can hardly suppose that such tests are perfectly adapted to their purpose; probably further improvement is possible.

There was a war emergency and the accomplishments were almost beyond belief. So far so good. But what of a comparable nature have we done or will we do to make careful the selection of peacetime leaders and diplomats to the end that the god of war will not enjoy many happy returns? Surely the tasks of diplomacy and international politics are as exacting as the tasks of a bomber crew. It is just as important that the men and women be fitted for the

tasks not only by natural aptitudes and abilities but by *training* as well.

The same improvement that may come to our own leadership by a better knowledge of individuals can accrue to other countries as well. They need the best leaders just as we do; scientific methods which work for us will work for them also; and when the highest type of leaders and diplomats are on both sides of every national boundary fence we have something besides wishful thinking on which to base our hope for better days.

3

But selection and training of national leaders must be undergirded by improved leadership and followership in every walk in life and in every town, village and hamlet. The soundness of our whole social structure, down to the individual people who are the fundamental units, is involved.*

We have the roots of war in the home, the church, the school; in every family disagreement, in every church row, in every educational strife. In these fields as well as in industrial and political activities, we get much of our psychological training and preparation for development of war attitudes.

How far a study of human beings can go to improve us in this respect is debatable. Many psychologists are of the opinion that our adult attitudes and leanings are often developed very early in life. It may be that we adults have ingrained in us a good deal which is undesirable and inescapable and that humanity can look for fuller relief only in our children and grandchildren. To what extent the spirit of tolerance, discussed in an earlier chapter, can be engendered by early educational recognition of wide variance between indi-

* Walter Lippmann has with outstanding success developed the theme that the essential political principle by which international problems can be solved is *"to make individuals, not sovereign states, the objects of international agreements: it is to have laws operate upon individuals."—One World or None,* McGraw-Hill, N. Y., 1946.

viduals is unknown. If we were brought up by parents who recognized these differences from the start and if we were trained to think from early youth in terms of a world in which each individual is a distinctive mosaic of traits and abilities, it might have more effect on our adult attitudes than we imagine. Because of our absorption in man-in-the-abstract we tend to judge our neighbor from across the street or across the ocean on the basis of our own standards of behavior and taste. When he behaves contrary to this standard we judge him as inferior. Our tolerance is worn thin by constantly using ourselves as a yardstick.

Whatever benefits in improved leadership and attitudes can be expected from a more thorough study of human beings, they cannot accrue unless they are made world-wide. International problems cannot be solved by having superior leadership in one or two countries alone. Fortunately for the spread of potent ideas, the pace at which the world is getting smaller is increasingly rapid. Science and understanding are like leaven, and their products, at least, are reaching the whole world. The study of human beings, too, must be world-wide, as is already the desire for peace.

4

If our knowledge of human beings within our own group is sketchy, as we have been led to conclude in our previous discussions, our ignorance regarding the distinctive characteristics of the various peoples of the world may be described as colossal.

The simplest way to escape this fact is Pollyanna's: "All men are brothers—hence they are all the same, in spite of appearances." Without detracting from the ideal of human brotherhood, we may remind ourselves that even blood brothers, in the literal sense, are by no means identical.

Another way to skirt around our lack of scientific knowledge is to register the results of more or less casual observations as though they constituted satisfactory information. I read a jouralistic article

recently in which one of the main points, plausibly and exhaustively maintained, was that Russians and Americans are fundamentally very much alike in their character traits. But what scientific knowledge do we have? How much effort has anyone expended to find out what the distinctive American and Russian traits are—assuming they exist—or how they compare?

Another journalist, a student of German affairs, writes with conviction how the German people regard themselves as building blocks in a pyramid and are quite happy to be sat upon and dominated so long as they can sit upon those who are beneath them. Can we set this down on the basis of observation as a distinctive German trait?

James W. Gerard, United States ambassador to Germany from 1913 to 1917, said in explaining how we lost the peace after World War I, "Public opinion was woefully uninformed on the nature of the German people." With all due respect to his greatness and his good intentions, Woodrow Wilson seems to have been in the same boat when he declared, "We have no quarrel with the German people." During the late war at least, we not only had a quarrel with the German people, we had a *fight* with them. It is highly desirable to know to what extent this fight was brought about by differences between the peoples involved.

When we find ourselves in a fight our tendency is to convince ourselves by propaganda and otherwise that our opponents are evil or crazy or both. This is always a ready and easy answer, but nine times out of ten it is probably the wrong answer. When there is strife between capital and labor it is easy to take sides and say one is bad and the other good, when actually both sides are merely human. It is an easy explanation of the latest European debacle to say "Hitler was a madman." If we knew the whole story of the human forces which came into play we would doubtless recognize how pitifully inadequate this explanation is. The character of the people unquestionably entered.

That members of the human family can interbreed is no proof that they are essentially all alike: animals may interbreed even

when they show extreme variability in size, in body shape, in intelligence and in temperament. This is true among horses, cattle, dogs, rats, mice, fowl, etc.

Anthropologists agree that races of human beings are often difficult to identify and that mixing of races has been common. If races are difficult to unscramble, that should not blind us to the fact that the original races, whatever they were, possessed distinctive anatomical, physiological, and psychological characteristics and if our racial origin is mixed, we have in our inheritance a mixture of these racial traits.

It is well recognized that the German people, for example, are racially heterogeneous. This does not mean, however, that they have in their make-up all the racial characters of all peoples. Just as they have predominantly, by inheritance, light-colored complexions, hair and eyes, it is entirely possible that on the average they may possess by inheritance a trait such as that mentioned above—the tendency to become regimented.

A heritable characteristic of hens in a flock is to tend invariably to assume a definite peck order of dominance, but many other birds lack, by inheritance, the same tendency. Some breeds of dogs are readily taught to observe strict discipline and are naturally submissive to authority while others incline to be far more independent. Cats as a group lack the trait which is ascribed to Germans. In a stern voice, command a cat to come to you and it is like Mahomet talking to the mountain.

Training can do a great deal to modify people but one wonders whether people's innate characteristics do not play an important part in determining their attitudes and behavior. It is said to be possible to condition cats so they will exhibit a number of the characteristic behaviors of dogs, and I presume that dogs can be conditioned to behave like cats. But how much easier it is for cats to learn to act like cats, and dogs to take on the behavior of dogs!

We used to read in our history books about warlike tribes. Assuming that such have existed and do exist, what is the basis of their warlike characteristics? Is it that, by some accident, they got

into the habit of fighting and kept on because of inertia, or is it because of an inborn possession of characteristics which made fighting seem more natural? Some breeds of dogs are pugnacious while others are not, indicating that the tendency to fight is heritable.

A recent careful study of the fighting tendencies of several different strains of mice (males) in the Jackson Laboratory at Bar Harbor, Maine, has showed that by inheritance there are differences between strains not only in their tendency to fight but also their fighting habits. The mice used were inbred and they were observed under conditions excluding the possible effects of training; they had had no previous opportunity to fight or to see fighting.[2] Each C57 mouse invariably showed an immediate interest in the intruding male which was placed with it for test purposes. Many friendly contacts were usually made and apparently at times the host would lick and clean his guest. These mice were pacific; they showed no aggressive fighting behavior. They would fight back, however, when attacked. Members of the C3H strain of mice characteristically tended to sniff the intruder briefly and then retire to the opposite side of the cage for several minutes. During this time the hair would fluff up and they would breathe in a labored fashion. If the intruder did not attack first they would then start a fight. The C strain of mice were found to be intermediate in behavior in that they made few friendly advances and had only a moderate tendency to start fights. In other studies when C57 mice and C3H mice were matched against each other and allowed to fight to the finish, the less aggressive pacific C57's had more victories to their credit than the aggressive C3H mice. This brings to mind certain human experiences in recent decades. Attention has been called earlier to the inheritance by rats of emotional traits, e.g., fearfulness, an observation in line with the Bar Harbor results.

Although it is a stratagem as old as history to study one's enemy from the standpoint of his leanings and tastes, likes and dislikes, we have paid scant attention to determining by scientific means the

distinctive characteristics of those peoples of the world who are our potential enemies or friends.

Because of a failure to study individuals and their traits by refined methods we are relatively in the dark about racial differences. Concerning the distinctive traits or potentialities of the Negroes, which would be expected to be distinctive in comparison with those of northern Europeans for example, we have little scientific information. Extensive application of Army alpha and beta tests at the time of World War I showed fairly conclusively that while white people made appreciably higher grades statistically, the spread within each race was much greater than the contrast between the two racial groups. But these tests were of a catch-all nature and not of the sort to show differences in the numerous types of abilities and the possession of significant and distinctive physiological and psychological traits. I do not pretend to have a ready-made and realistic solution of the race problem but I do think that in terms of the general principle, knowledge precedes intelligent action and that studying the characteristics of the races in an objective fashion will help.

Among those who want better race relations, and better relations between majorities and minorities, some would decry any study of racial differences on the ground that it would magnify our difficulties. They say of a minority group, "If they are different, let's forget it; we all belong to a human brotherhood."

While I have great sympathy for the objectives of those who have such an attitude, I cannot help being repelled by the philosophy ascribed to the ostrich—that the proper reaction toward unpleasant facts is to hide one's head. To recognize the facts and adjust to them seems safer. Even within a family of blood brothers and sisters with marked differences in temperament, it seems obvious that friendly relations will be more likely if these differences are recognized and their basis understood. Nothing in the way of better relations will be gained by assuming sameness and ignoring individuality. Some of the bitter antagonisms which not infrequently are

built up between members of the same family could doubtless be avoided by educating children in early life to expect wide variance of tastes and traits even on the part of their own brothers and sisters.

A thorough study of individuals from different racial groups, in the sense that we have advocated it, will doubtless reveal psychological differences. Whenever a group of people are sufficiently inbred and sufficiently distinctive to possess characteristic facial or bodily features, it seems reasonable to suppose that study of their numerous mental capacities and characteristics would reveal that they have psychological characteristics in common also. Of course, every member of the human family will be found to have mental traits which are more or less distinctive and so no stigma can be attached to the mere possession of distinctiveness. Furthermore a wide spread will be found within each racial group; it will be quite apparent that individuals cannot be described in terms of a set of characteristics which are the possession of the group.

A frank recognition of differences, when they exist, and making allowance for them when they have a hereditary physiological basis, is superior as a policy to ignoring them and hoping that they will not be the source of trouble. The old saying "We need more light and less heat" applies to racial problems as well as to others. In the long run social housekeeping which hides unattractive information under the bed can hardly be recommended.

One of the results of the study of racial differences will be, I feel sure, to discredit forever the idea that there is such a thing as a "master race." We will doubtless find that certain peoples as a group tend to be superior *in some physiological and psychological traits, but that others will have their distinctive superiorities, too.* We can rest assured that no race or group will be found superior in every desirable trait. Harking back to biology, there is no such thing as a breed of horses that is superior *in every way* to all other horses, nor is there a universal breed of dogs which excels all dogdom in the multitude of desirable canine traits. Races of mankind cannot be rated as good, better, or best any more than individuals can. We are

not *superior* to Chinese nor are they *superior* to us. We are *different* and cannot be measured or compared using a single yardstick.

The people of Germanic origin, who are not rated very highly at present because of the two twentieth-century debacles in which they have played a leading part, doubtless have their superiorities, too, but the idea that they are the master race is preposterous scientifically, regardless of the outcome of the wars. A thorough search for the scientific facts regarding the possession of traits by individuals and by racial groups will undoubtedly reveal the complete unsoundness of the master race idea and that the thought can be banished from the world. Scientific appreciation of these facts of life will be good medicine also for the Japanese to absorb.

An intensive study of human beings will not only reveal individual differences but will bring into relief the likenesses that exist. We need to recognize that all peoples of the world have a love of home and that it is almost as natural as breathing to love the land or region in which one was born and reared. Depreciating another man's native state or country is almost a certain way to gain his enmity. We all have our local heroes. Our local pride which if not carried too far is relatively harmless, is as widespread as geography. If we live in the atmosphere of Edinburgh we become imbued with the conviction that Sir Walter Scott was supreme in the field of letters and Simpson, who early used chloroform as an anesthetic, was supreme in the field of science. If we move to Oslo or Heidelberg or Paris we find others there equally devoted to the local gods. There are not a few discoveries for which several countries claim the credit and the proponents of each candidate for the honor are sure that they are right.

We in the United States need to appreciate that every world inhabitant has a right to his own loyalties. Our adoption of the term "Americans" to designate ourselves is a case in point, and if we knew and appreciated the feelings of other people in the western hemisphere we would officially repudiate the term. Whenever we use it we say in effect, "We are *the* Americans; others on the American continents count for little." However important we may be,

this is a gesture which is highly unbecoming. We have no right, because of Canada, Mexico and the Central American countries, to designate ourselves even as *the* North Americans. Perhaps "Usians" (pronounced analogous to Asians) would be a good term to apply to citizens of U. S. A.

Chest thumping is puerile and it is hoped that intercommunication and travel will lead us to avoid it in ourselves as we discountenance it in others. Thorough exploration into the traits and abilities of our world neighbors will lead to higher appreciation and consideration. Knowing ourselves and our neighbors better will be conducive to wider sympathies and lead to a universal loyalty to humanity on a realistic basis. While we have emphasized differences, because relatively they have been neglected, human beings have all the fundamental urges in common. *Enlightened* human brotherhood should be our goal.

Epilogue

There exists in the world today a gigantic reservoir of good will.

WENDELL L. WILLKIE

THE PERFECTION OF MAN has been a philosophic ideal throughout the ages.

In order for man to improve himself (1) he must have the capacity for formulating his ideal, (2) he must have the will to follow through, and (3) he must know how to accomplish his purpose.

The value of human exploration lies principally in its contribution to the third item—to the problem of how to accomplish our purposes. In our discussions, we have accepted prevalent ideals and values and have taken largely for granted the existence of these as well as an urge to attain them.

Observation leads to the belief that in humankind, there is a vast reservoir of good will and an idealism which in general exceeds its achievements. This being the case, our progress is often limited not by our lack of ideals or lack of desire, but rather by our lack of technique. Particularly is this apparent in the prevention of war. So many peoples in so many lands devoutly wish for peace, but again and again they are trapped, and peace eludes them for lack of knowing *how* to achieve it.

We cannot rely on the scientific method for the formulation of our ideals nor for the motive power which will urge us on. This is the province of religion. If we believe that man has in him idealism

and good will that can be cultivated, we believe (in theological terms) in the immanence of God. But if we take for granted the ideal and the urge, we are still confronted with the problem of how to improve ourselves and our social order. This we cannot accomplish without human ingenuity and without science.

Art, music and literature are not the products of science. Neither is religion. But the efficacy of art, music, literature and religion in modifying human existence can be demonstrated scientifically, and science can help us greatly in the appraisal of human progress toward established goals. Science cannot tell us where to go or why, but it can tell us much about where we must start and how we can travel toward the goal once we have set it.

2

If we wish to be more tolerant, humanics can readily give us the insight that will make it easier to be so; if we wish to follow the golden rule, how far we attain to it will be determined by how well we can see into our neighbor's life.

If we wish to be well mentally as well as physically, scientific study of ourselves and others can vastly improve our techniques for accomplishing our aim. This is especially true of those whose assortment of physiological and psychological traits is most distinctive.

If we accept the ideal of choosing a mate with whom one may live continuously in loving relationship, humanics, especially when it is further developed, can be of vast aid.

If it is our desire that children be reared for maximum development, and that their education be directed along lines distinctively suited to their needs, these desires are liable to be frustrated unless we have a scientific appreciation of their distinctive attributes.

If we want our leaders to be most suitable for their tasks, scientific study can help us choose them successfully. If it is our ideal to have society organized so that the individuals within it have a

chance for the fullest achievement, only a study of individuals can give us the insight that is essential.

If our inner urge makes us wish for peace on earth, we must use our human ingenuity to build the kind of social order that will promote peace. To do this we must learn to adjust to each other as we really are. *Humanity must understand itself.*

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